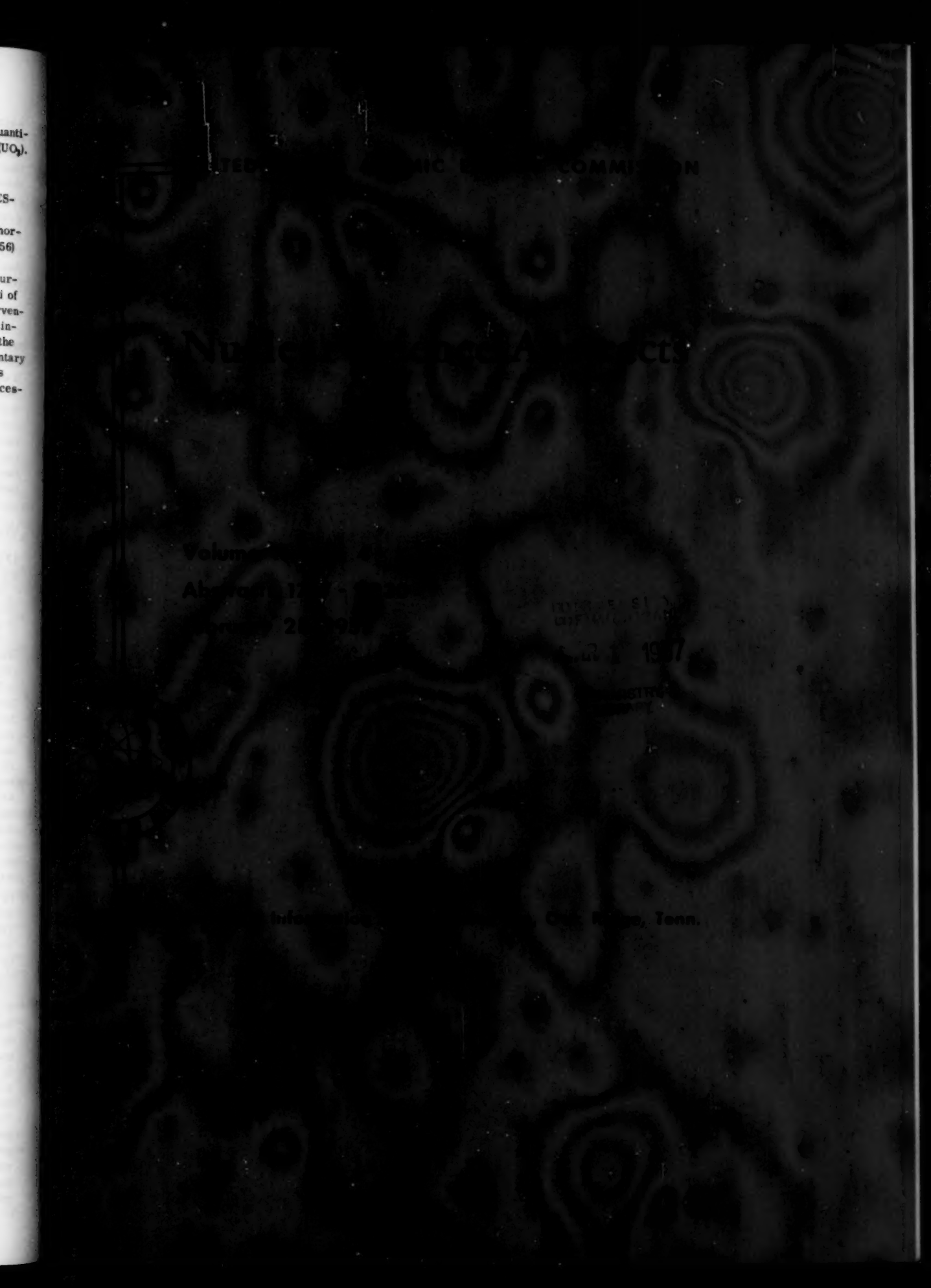

SOVIET PHYSICS

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Journal of Experimental and Theoretical Physics - 1955 - $30.00/yr.; 1956 - $60.00/yr.

Journal of Technical Physics - 1956 - $60.00/yr.

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NUCLEAR SCIENCE ABSTRACTS

Volume 11 February 28, 1957 No. 4

GENERAL

ATOMIC POWER

1717 CEA-379
France. Commissariat a l'Energie Atomique, Paris.
PERSPECTIVES IMMINENTES DE L'APPLICATION INDUSTRIELLE DE L'ÉNERGIE ATOMIQUE. (Impending Perspectives of the Industrial Application of Atomic Energy). L. Kowarski. Jan. 22, 1955. 22p.

The quick development of the industrial application of atomic energy is discussed. Nuclear fuels, different types of reactors and the state of progress in the U. S., Canada, England, and Russia in experimental reactors, Pu production, and power production are summarized. The problems in metallurgy, radioisotope utilization, competition with hydroelectric power and the use of U minerals in France are included. (F.S.)

1718 AEC-tr-2397
ATOMIC ENERGY SERVES MANKIND. V. Leshkovtsev. Translated from Krylya Rodiny No. 9, 19-21(1954). 24p. (F-TS-8465/V(p.11-24)).

Achievements and prospects in the field of peaceful utilization of atomic energy in Russia are discussed. (auth)

RESEARCH PROGRAMS

1719
ATOMIC ENERGY IN EASTERN EUROPE. PART I. POLAND. J. F. Calor. Nuclear Eng. 1, 363-6(1956) Dec.

BIOLOGY AND MEDICINE

1720 USNRDL-TR-113
Naval Radiological Defense Lab., San Francisco.
BACTERICIDAL ACTIVITY OF LEUCOCYTIC EXTRACTS. M. Fishman, M. S. Silverman, and L. J. Cole. Aug. 30, 1956. 28p. Project NM 006-015.04.

1721 AEC-tr-2661
SYNTHESIS OF NUCLEIC ACIDS IN HOMOGENATES AND IN ISOLATED NUCLEI OF TUMOROUS AND NORMAL CELLS. A. K. Belousova. Translated from Biokhimiya 20, 496-506(1955). 27p.

1722
CANCER CHEMOTHERAPY—A BIBLIOGRAPHY OF AGENTS, 1946-1954. Marjory C. Spencer, Elizabeth Beyerly, Elizabeth Koenig, and Katherine Uhler, comps. Cancer Research 16, Suppl. No. 4, Nov. 1956. 297p.

RADIATION EFFECTS

1723 AD-93911
Wisconsin Alumni Research Foundation, Madison.
ANIMAL FEEDING STUDIES ON WHOLESOMENESS OF IRRADIATED FOODS. Progress Report No. 1 [for] January 15, 1955 to May 15, 1955. L. J. Teply and B. E. Kline. 13p. Contract DA-49-007-MD-608.

Twelve irradiated food items were used in eight-week feeding tests employing young rats. Food items tested include dried apricots, frozen brussel sprouts, frozen cherries, frozen cranberries, crackers, Jello powder, macaroni, dried pears, frozen peas, pound-cake, pork sausage, and frozen shrimp. In general there was no marked difference in the growth rates of control rats and those fed irradiated foods except for diets containing Jello powder. (C.H.)

1724 AF-SAM-56-50
Utah. Univ., Salt Lake City. Coll. of Medicine.
ASPECTS OF THE RELATIONSHIP BETWEEN IRRADIATION INJURY AND MAMMALIAN HOST DEFENSE MECHANISMS: A REVIEW. David M. Donaldson and Stanley Marcus. Nov. 23, 1955. 22p.

This study reviews and evaluates the principal work, accomplished to date, pertaining to the effect of irradiation on the ability of the host to resist an infection. Included in the survey are sections on cellular defenses, humoral defenses, respiratory tract clearance, and trauma, as related to irradiation. (auth)

1725 UCLA-338
California. Univ., Los Angeles. Atomic Energy Project.
QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1955. July 1, 1955. Decl. Mar. 20, 1956. 96p. Contract AT-04-1-GEN-12. $15.30(ph OTS); $5.40(mf OTS).

Progress is reported in the following studies: biological studies on mouse leukemia; the isolation and study of high molecular weight polysaccharides and nucleic acids; the physical properties of biological macromolecules; the synthesis and chromatographic analysis of unsaturated fatty acids; the effects of irradiation on the excretion of histamine in rats; the effects of liver- and spleen-shielding on concentration of blood serum Fe in rabbits; the effects of intestinal extract and of bulbocapnine hydrochloride on the survival time of irradiated mice; the effects of x irradiation on the work capacity of rats; the effects of particle size on pulmonary absorption and distribution of fall-out particles and dust in rabbits and rats; the protective effects of reticulo-endothelial system stimulation against acute whole-body x radiation in rabbits; the development of kidney function tests employing I^{131}-labeled Urokon and Diodrast; factors affecting the bone deposition of Sr^{90}; the effects of radiation on the constituents of embryonic serum; the response of germanium dosimeters to fast neutron flux; and a comparison of chemical film, and fission foil methods for the dosimetry of mixed neutron–γ fields. (C.H.)

1726
PULMONARY RADIATION EFFECTS AS A FUNCTION OF ABSORBED ENERGY DISTRIBUTION. H. Cember, J. A. Watson, and T. B. Grucci (Graduate School of Public Health, Univ. of Pittsburgh). Am. Ind. Hyg. Assoc. Quart. 17, 397-400(1956) Dec.

1727
EFFECTS OF TOTAL BODY X-IRRADIATION AND PLUTONIUM INJECTION ON THE CHOLINESTERASE OF ERYTHROCYTES AND BRAIN. Jean C. Sabine (Los Alamos Scientific Lab., N. Mex.). Am. J. Physiol. 187, 275-9(1956) Nov.

Both total body x-irradiation (25 to 300 r) and injected plutonium (0.63 μc Pu^{+6}) produce an increase in the cholinesterase activity of erthrocytes of mice on the 4th day. In mice receiving 300 r, high values were found on the 3rd-5th days. Subsequently there was a sharp fall in this titer to values far below normal at the end of the 1st week. During the 2nd week recovery began and was apparently complete by the end of the 3rd week. The reticulocyte count was significantly depressed during the 1st week, and there was a small but significant reticulocytosis during the 3rd. In the plutonium-injected mice, the same early peak was observed and the same fall to values well below normal. There was no recovery during 63 days of observation. Data are presented for the 4th day following doses of x-rays from 15–300 r. From 25 r upwards there is a significant increase in the mean cholinesterase titer. There appears to be a relationship between the proportion of high individual titers and the dose, and the highest individual values were observed at 300 r. Data are presented on a large series of control mice, and these are shown to conform well to the normal distribution as evaluated by k-statistics. (auth)

1728

INACTIVATION OF CHOLINESTERASES BY GAMMA RADIATION. Jean C. Sabine (Los Alamos Scientific Lab., N. Mex.). Am. J. Physiol. 187, 280-2(1956) Nov.

Animals and in vitro preparations of cholinesterase were exposed to massive doses of gamma radiation from a barium-lanthanum source and from two x ray sources. The cholinesterase activity and the activity-pS kinetics of rat brain were unaffected by an in vivo dose of 60,000 r from the isotope source. The animals were in violent convulsion and had severe diarrhea at the time they were killed. The activity of whole human plasma was unaffected by 100,000 r of 1000-kvp x rays. Dilute hemolysate of human blood in 0.1% gelatin was inactivated 10% by 150,000 r of 250-kvp x rays. Purified cholinesterase in dilute sheep serum was inactivated at a rate of 15%/100,000 r of 250-kvp x rays. In M/15 phosphate buffer containing 0.1% bacteriological gelatin it was inactivated at a rate of 50%/100,000 r from the isotope source. In buffer alone it was inactivated at a rate of 21%/10,000 r from the isotope source. The relationship between dose and effect appears to be linear, and this is attributed to the very low concentration of enzyme molecules which makes the probability of a second hit negligible. The gradation of protection is regarded as a nonspecific effect, a function of the concentration of large molecules which compete for the ionization. The enzyme was not protected by a high concentration of its substrate. While the enzyme can be inactivated by gamma irradiation, the conditions required are so different from those found in the intact animal that the signs and symptons resembling cholinergic manifestations observed with supralethal doses cannot be explained in terms of inactivation of cholinesterase by the radiation. (auth)

1729

EFFECTS OF RADIATIONS ON CATALASE SOLUTIONS. 1. KINETIC STUDIES OF INACTIVATION. H. C. Sutton (Univ. of Otago Medical School, Dunedin, New Zealand). Biochem. J. (London) 64, 447-55(1956) Nov.

1730

EFFECTS OF RADIATIONS ON CATALASE SOLUTIONS. 2. THE PROTECTING ACTION OF COMPLEXING AGENTS. H. C. Sutton (Univ. of Otago Medical School, Dunedin, New Zealand). Biochem. J. (London) 64, 456-60(1956) Nov.

1731

THE RESPONSE OF ADRENAL GLAND OF INFANTILE RATS TO STRESS EFFECTS OF X-RADIATIONS. Djurdjina S. Sladić, Miroslava R. Pavlović, and Dušanka V. Radivojević. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 199-202(1956) Mar.

New born rats up to 10 days of age do not react to stress effected by x rays. Fall in concentration of cholesterol, 3 hrs following x irradiation, was observed for the first time in animals 10 days old. Under our experimental conditions, adrenal ascorbic acid content begins to fall only in older infant rats i.e. after 13 days of age. Furthermore, this decline was gradual and parallelling the age. An exposure of animals to the same experimental conditions causes a different adrenal response with respect to adrenal ascorbic acid and cholesterol in animals 10 to 13 days old. (auth)

1732

THE EFFECT OF X-RADIATION OF THE YOSHIDA ASCITES TUMOR. I. INHIBITION OF MITOSIS BY A SINGLE IRRADIATION. John Gordon Freymann (Massachusetts General Hospital, Boston). Cancer Research 16, 930-6 (1956) Nov.

1733

RELATIVE BIOLOGICAL EFFECTIVENESS OF TRITIUM AND OF VARIOUS γ RADIATIONS. Sylvie Davydoff. Compt. rend. 243, 1455-7(1956) Nov. 5. (In French)

A determination was made of the relative biological effectiveness of tritium and of various γ radiations with respect to a bacteria, Serratia indica. No matter what the intensity of the irradiation, the various γ radiations have had the same biological effectiveness, that of the tritium β ray being less, with a factor of relative biological effectiveness of 0.87. (tr-auth)

1734

EFFECT OF NUTRITIVE FACTORS ON THE SURVIVAL OF SERRATIA INDICA AFTER γ IRRADIATION. Sylvie Davydoff. Compt. rend. 243, 1683-5(1956) Nov. 19. (In French)

A comparison is made, after γ irradiation, of the survival portion of S. indica when the bacteria is scattered in a complete nutritive medium and a simple synthetic medium. (tr-auth)

1735

EFFECTS OF X RAYS IN THE EARLY STAGES OF EMBRYOGENESIS. V. I. Khel'sina (Pavlov Leningrad Medical Inst.). Doklady Akad. Nauk S.S.S.R. 110, 57-60(1956) Sept. 1. (In Russian)

1736

EFFECTS OF γ EMISSION OF RADIOACTIVE COBALT (Co^{60}) ON THE PROTEIN AND AMINO ACIDS (LESGRAFT STATE INST. OF NATURE STUDIES). Doklady Akad. Nauk S.S.S.R. 110, 125-8(1956) Sept. 1. (In Russian)

A review is given of the studies on radioactive emission and supersonic effects produced upon the supermolecular compounds and their monomers. Data are presented from studies on the effects of γ emission on protein and amino acids. The work was initiated in 1952 and has been continued up to date. (R.V.J.)

1737

EFFECTS OF X RAYS EMITTED FROM VARIOUS ANODES UPON THE WORK OF ISOLATED HEART OF A FROG. S. E. Manoĭlov, A. V. Lazovskaya, and B. A. Orlov (Central Research Inst. of Roentgen-Radiology). Doklady Akad. Nauk S.S.S.R. 110, 305-7(1956) Sept. 11. (In Russian)

1738

EFFECTS OF SMALL DOSES OF IONIZING RADIATION ON THE PARAMAECIUM CANDATUM (CONTRIBUTION TO THE PROBLEM OF RADIOSTIMULATION). E. Ya. Graevskiĭ and E. G. Zinoveva (Severtsov Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 110, 379-82 (1956) Sept. 21. (In Russian)

The obtained data indicated that the increase in the rate of infusoria division was caused by the salts and admixtures and not by radiation effects. The ionizing radiation used in small quantities in the experiment did not produce any stimulating effects but slowed down the rate of division in paramecium. (R.V.J.)

1739

REACTION OF OXOLOTL CELL ELEMENTS TO THE TOTAL X RADIATION. A. F. Ivanitskaya (Severtsev Inst. of Animal Morphology). Izvest. Akad. Nauk S.S.S.R. Ser. Biol. No. 5, 85-97(1956) Sept.-Oct. (In Russian)

1740

SEVERAL FACTORS WHICH INFLUENCE THE RATE OF AVENA COLEOPTILE RESPIRATION. A. R. Schrank (Univ. of Texas, Austin). J. Cell. Comp. Physiol. 48, 77-85(1956) Aug.

The endogenous respiration of individual Avena coleoptiles taken from seedlings 96 hours old was measured in aluminum microrespirometers. Uniform rates were maintained for at least two hours. Geotropic stimulation and decapitation cause slight increases in the rate of oxygen consumption. The rates of oxygen utilization of coleoptiles grown from seeds exposed to gamma rays from Co^{60} are dependent on the radiation dosage. Doses from 5,000 to 10,000 r inhibit the rate of oxygen consumption. From 0 to 5,000 r there is a slight increase in the respiration rate, and from 10,000 to 100,000 r there are several cycles of increased and decreased rates which result in a net increase of 39%. Since coleoptiles grown from seeds exposed to 100,000 r manifest an increased rate of respiration but grow only one-fourth as long as controls, the inhibition of growth by gamma rays apparently is not dependent on the effects of irradiation on O_2 consumption. (auth)

1741

EFFECT OF IN VITRO X IRRADIATION ON PIGMENTED AND PALE SLICES OF CLOUDMAN S91 MOUSE MELANOMA AS MEASURED BY SUBSEQUENT PROLIFERATION IN VIVO. Jewel Plummer Cobb (Univ. of Illinois Coll. of Medicine, Chicago and Harlem Hospital, New York). J. Natl. Cancer Inst. 17, 657-66(1956) Nov.

1) The in vitro irradiation of pigmented and pale slices of the Cloudman S91 mouse melanoma with 2500, 2800, or 3000 r revealed that a larger number of pigmented slices remained viable following treatment. Viability was measured by the number of irradiated implants growing successfully in DBA mice, the strain of tumor origin. 2) The relatively greater radioresistance in vitro of pigmented, as compared to pale, tissue was accompanied by an increased number of melanized cells. An explanation for this phenomenon is discussed. (auth)

1742

MALFORMATION OF THE ADULT BRAIN (ALBINO RAT) RESULTING FROM PRENATAL IRRADIATION. Helena E. Riggs, John J. McGrath, and Henry P. Schwarz (Philadelphia General Hospital, Penna.). J. Neuropathol. Exptl. Neurol. 15, 432-47(1956) Oct.

1743

EFFECT OF FAST NEUTRONS ON DIFFERENT STAGES OF SPERMIOGENESIS IN DROSOPHILA MELANOGASTER. K. G. Lüning (Univ. of Stockholm, Sweden). Nature 178, 1123-4(1956) Nov. 17.

1744

SENSITIVITY OF IMMATURE MOUSE SPERM TO THE MUTAGENIC EFFECTS OF X-RAYS. A. J. Bateman Cytogenetics Department, Christie Hospital and Holt Radium Institute, Manchester, Eng.). Nature 178, 1278-80 (1956) Dec. 8.

1745

STUDIES ON THYMUS OF THE MAMMAL. IX. HISTOCHEMICAL STUDY OF IRRADIATED MOUSE THYMUS. Christianna Smith (Mount Holyoke Coll., South Hadley, Mass.). Proc. Soc. Exptl. Biol. Med. 93, 310-14(1956) Nov.

1746

CADMIUM SULFIDE PHOTORESISTANCE TO γ and β RADIATION. S. V. Svechnikov. Zhur. Tekh. Fiz. 26, 1646-50(1956) Aug. (In Russian)

Radioactive isotopes of Co^{60} and P^{32} were used as radioactive source to determine the photoresistance properties of monocrystalline and polycrystalline specimens of prepared CdS. Diagrams are given of CdS photoresistance to ionizing radiations. It was observed that CdS had a considerably stronger photoresisting sensitivity to corpuscular radiation (α and β) than to γ-radiation. (R.V.J.)

RADIATION HAZARDS AND PROTECTION

1747 HW-45983

Hanford Atomic Products Operation, Richland, Wash. RADIOACTIVITY LEVELS OF THE COLUMBIA RIVER BELOW RICHLAND, WASHINGTON FOR THE PERIOD JANUARY, FEBRUARY, MARCH 1956. H. V. Clukey. Oct. 9, 1956. 9p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

In the Columbia River downstream from Richland, Washington there is a gradual decrease in concentration of radioactive isotopes. At any one location there are fluctuations due to factors such as dilution and decay time. During this period at all locations the concentration of alpha particle emitters in water averaged below the detection limit of 5×10^{-9} μc/cc. In mud, all alpha particle emitter concentrations were below the detection limit of 3×10^{-6} μc/gm. Beta particle emitters in water upstream of McNary Dam increased by a factor of 1.5 to 2, with averages at various locations ranging from (3 to 40) $\times 10^{-7}$ μc/cc, but in river mud the average of 2×10^{-5} μc/gm was about $^2/_3$ that during the previous quarter. Downstream from McNary Dam, beta particle emitter average concentrations in water were about the same as those during the past three quarters. (For preceding period see HW-42946.) (auth)

1748 HW-46094

Hanford Atomic Products Operation, Richland, Wash. RADIOACTIVITY LEVELS OF THE COLUMBIA RIVER BELOW RICHLAND, WASHINGTON FOR THE PERIOD APRIL, MAY, JUNE 1956. H. V. Clukey. Oct. 17, 1956. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

In the Columbia River downstream from Richland, Washington there is a gradual decrease in concentration of radioactive isotopes. At any one location there are fluctuations due to factors such as dilution and decay time. During this period at all locations the concentration of alpha particle emitters in water averaged below the detection limit of 5×10^{-9} μc/cc. Special analyses for uranium showed an average of 1.1 μg/cc (7×10^{-10} μc/cc). In mud, all alpha particle emitter concentrations were below the detection limit of 3×10^{-6} μc/gm. Beta particle emitters in water upstream of McNary Dam decreased slightly due to increased river flow this quarter, with averages at various locations ranging from (3 to 25) $\times 10^{-7}$ μc/cc, but in river mud the averages of 2×10^{-5} μc/gm were about the same as the previous quarter. Downstream from McNary Dam, beta particle emitter average concentrations in water were about the same as the past three quarters. (For preceding period see HW-45983.) (auth)

1749 NYO-3434
Princeton Univ., N. J.
THE NATURE OF ATMOSPHERIC DUST: RADIOACTIVE AND ELECTRON MICROSCOPE MEASUREMENTS ON FALL-OUT ON PRINCETON, NEW JERSEY, OCTOBER 21, 1954 TO AUGUST 10, 1955. Progress Report to August 31, 1955. Clarence Heininger and John Turkevich. Dec. 1, 1955. 24p. Contract AT(30-1)-1301. $0.25(OTS).

The amount of radioactivity in the air and in fall-out at Princeton University has been monitored over a period of about ten months. Abnormally high activity was observed coincident with AEC tests in Nevada in the spring of 1955. Both decay and Al absorption data were obtained for some of the more active samples. Electron micrographs have been taken of air-borne and rain-borne dust collected at Princeton University and of rain-borne dust collected at the Brookhaven National Laboratory. In one case the Brookhaven dust was shown, by electron diffraction, to contain $CaCO_3$ (aragonite). (auth)

1750 WT-1165
Federal Civil Defense Administration, Battle Creek, Mich.
INDOCTRINATION AND TRAINING OF RADIOLOGICAL DEFENSE PERSONNEL. Roscoe H. Goeke. Nov. 1955. 22p. Project 38.2 [of] OPERATION TEAPOT. $0.25(OTS).

A on-site training project was conducted to provide field experience under actual nuclear-explosion conditions for personnel having responsibilities in radiological defense planning and operations in state and local civil defense organizations. A brief outline of the training program is presented. (C.H.)

1751 WT-1183
California. Office of Civil Defense, Sacramento and Federal Civil Defense Administration, Battle Creek, Mich.
OFF-SITE RADIOLOGICAL DEFENSE TRAINING EXERCISE. Charles T. Rainey. Dec. 1955. 15p. Project 38.5 [of] OPERATION TEAPOT. $0.15(OTS).

An off-site training exercise was designed to provide realistic experience for personnel with state and local responsibilities in radiological defense. The operational schedule is presented. (C.H.)

1752 WT-1222
Food and Drug Administration, Washington, D. C. and Federal Civil Defense Administration, Battle Creek, Mich.
EXPOSURE OF FOODS AND FOODSTUFFS TO NUCLEAR EXPLOSIONS. A Summary of Results. Edwin P. Laug. May 1956. 19p. [Project] 32 [of] OPERATION TEAPOT. $0.20(OTS).

Over 100 different foods frequently used in the American diet were exposed to the effects of an atomic explosion. In addition 19 elements known to occur in food were exposed as pure salts, dry and in aqueous solutions. Exposure stations represented a variety of storage conditions and ranged from 1050 to 15,000 ft. from Ground Zero. All foods and their containers became more or less radioactive when exposed within one-fourth mile of Ground Zero. At distances greater than this little or no radioactivity was noted. No significant toxic by-products were formed in any of the exposed foods. It was concluded that if residual radioactivity in an area has declined sufficiently to make personnel access possible, consumption of food from such an area would be justified, but only under disaster conditions and for periods of only 2 to 3 weeks duration. Application of findings to conditions following a thermonuclear explosion is discussed. (C.H.)

1753
RADON AND RADON DAUGHTER HAZARDS IN MINE ATMOSPHERES. Richard D. Coleman, Howard L. Kuznetz, Paul F. Woolrich and Duncan A. Holaday (United States Dept. of Health, Salt Lake City). Am. Ind. Hyg. Assoc. Quart. 17, 405-10(1956) Dec.

1754
RADIOLOGICAL HAZARDS DUE TO EXPOSURE TO LOW-ENERGY RADIATION IN VETERINARIANS. A. Abrahams, S. J. Harris, I. Paul, and G. W. Paul (New York State Dept. of Labor and New York City Health Dept.). Arch. Ind. Health 14, 521-5(1956) Dec.

A survey of radiation hazards among veterinaries included about one-third of such establishments in the Greater New York metropolitan area. Measurements of the intensity of the radiation and estimates of the duration of exposure revealed the existence of potentially hazardous conditions in a considerable proportion of establishments. Actual damage had occurred in some veterinarians and is reported separately. Fluoroscopy presents greater hazard than radiography and is in more extensive use. Lack of safety consciousness in choice and use of equipment and in neglect of protective measures adds to the hazard. A number of factors necessary to adequate control, applying the cardinal radiation protection principles of time, distance, and shielding, are discussed. These measures can be effective only when intelligently applied by knowledgeable persons. (auth)

1755
EXPERIMENTAL TREATMENT OF POISONING FROM FISSION PRODUCTS. ABILITY OF CHEMICAL AGENTS TO ALTER THE UPTAKE AND RETENTION OF FISSION PRODUCTS IN ANIMALS EXPOSED TO RADIOACTIVE FALL-OUT. S. H. Cohn, J. K. Gong, and W. L. Milne (U. S. Naval Radiological Defense Lab., San Francisco). Arch. Ind. Health 14, 533-8(1956) Dec.

The ability of zirconium citrate and edathamil sodium to alter the distribution and retention of both an injected mixture of long-lived fission products and an inhaled mixture of short-lived fission products was measured. The mixture of long-lived fission products contained those isotopes which present the most serious health hazard from the point of view of chronic internal irradiation. The whole spectrum of fission products used in the inhalation experiment reproduces an acute exposure to fall-out following nuclear detonation. The most effective chemical agent for the prevention of skeletal deposition of both short- and long-lived fission products is zirconium citrate, preferably administered shortly before injection or exposure to MFP (mixed fission products). Post-treatment is also useful, within limits. Treatment following MFP exposure must be made within an hour for maximum effectiveness; after this time only slight changes in MFP retention are noted. Treatment which reduces the skeletal deposition effectively increases the deposition in the soft tissues other than liver; this effect was noted with the zirconium citrate. The most effective treatment for reducing the MFP content in the liver was pretreatment with edathamil and post-treatment with zirconium citrate. Excretion of MFP is also increased most by this treatment. However, while the skeletal deposition is reduced, it is not altered as much as by pretreatment with zirconium citrate alone. (auth)

1756
ON THE MODE OF ACTION OF X-RAY PROTECTIVE AGENTS. I. THE FIXATION IN VIVO OF CYSTAMINE AND CYSTEAMINE TO PROTEINS. Lorentz Eldjarn and Alexander Pihl (Norwegian Radium Hospital, Oslo). J. Biol. Chem. 223, 341-52(1956) Nov.

The metabolism in mice of the x-ray protective agents cystamine and cysteamine has been reinvestigated with the aid of S^{35}-labeled compounds of extremely high specific ac-

tivity. In principle the same results were obtained whether cystamine or cysteamine was administered. During the period when these compounds offer optimal protection, the bulk of the cystamine and cysteamine in blood occurred bound to intra- and extracellular proteins and to other blood constituents. Evidence is presented that this is due to the formation of mixed disulfides between cysteamine and the SH groups of the body constituents. The radiobiological significance of the data has been discussed. (auth)

1757
BIOLOGICAL PROBLEMS IN INTERPLANETARY FLIGHTS. I. S. Balakhovskiĭ and V. B. Malkin. Priroda 45, 15-21 (1956) Aug. (In Russian)

RADIOTHERAPY

1758
SEEDS OF PURE BETA-RAY EMITTER (YTTRIUM-90) FOR RADIATION HYPOPHYSECTOMY. J. R. Mallard, A. McKinnell, and P. E. Francois (Hammersmith Hospital, London). Nature 178, 1240-1(1956) Dec. 1.

Seeds of Y^{90} were prepared for use in radioinduced hypophysectomy. The radiation properties of the seeds are described. (C.H.)

TOXICOLOGY STUDIES

1759 AEC-tr-2663
URANIUM ABSORBED IN THE HUMAN BODY BY EATING AND DRINKING. Joseph Hoffmann. Translated from Chem. Ztg. 67, 49-52(1943). 20p.

1760
INFLUENCE OF COMBINED ADMINISTRATION OF VITAMIN A AND CALCIUM ETHYLENEDIAMINE TETRAACETATE ON THE ELIMINATION OF RADIUM D IN RATS. M. K. Nerurkar and M. B. Sahasrabudhe (Indian Cancer Research Centre, Bombay). Proc. Indian Acad. Sci. 44B, No. 2, 73-8(1956).

Vitamin A was found to be effective in reducing the retention of RaD in the bones of rats, while Ca-EDTA was more effective in lowering soft-tissue retention of RaD. When both agents were used concurrently it was possible to remove a major portion of the deposited RaD from skeleton as well as from soft-tissues. (C.H.)

TRACER APPLICATIONS

1761 HW-43836
Hanford Atomic Products Operation, Richland, Wash.
GASTROINTESTINAL ABSORPTION, DISTRIBUTION, AND RETENTION OF PHOSPHORUS (P^{32}) BY RATS FOLLOWING FEEDING IN VARIOUS FORMS. B. Kawin and R. F. Palmer. June 21, 1956. 23p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Following a single feeding of rats with either inorganic P^{32}, P^{32} incorporated in fish muscle, or P^{32} incorporated in plant leaves, no statistically significant differences in P^{32} distribution and excretion ascribable to the source of radioactivity were found over an experimental period of 40 days. About 25% of the P^{32} fed was not absorbed from the gastrointestinal tract and was rapidly excreted in the feces. The excretion of the absorbed fraction of P^{32} appeared to be distributed equally between urine and feces. There was no significant change in the quantity of radioactivity in the skeleton, which amounted to 13.5% of the fed dose of P^{32}, throughout the period covered by the experiment. The concentrations of P^{32} in the liver and other soft tissues were proportional to the P^{32} concentration of the blood. Studies of the distribution of inert and radioactive phosphorus in teeth and bones of the rat skeleton following intragastric administration showed a high concentration of inert phosphorus in teeth as compared to bone. The P^{32} was rapidly taken up and retained without loss by both bones and teeth. The P^{32} concentration was greatest in the incisors, less in the bones, and least in the molars. The femur was found to be a reliable measure of total skeletal P^{32} deposition, and the ratio, skeletal P^{32} to femur P^{32}, amounted to 24.6 ± 1.2. Compared to those reported for humans, the calculated differential absorption coefficients were similar, but the P^{32} concentrations of the bones differed. (auth)

1762 USNRDL-TR-112
Naval Radiological Defense Lab., San Francisco.
TEMPERATURE EFFECTS ON RADIOCOLLOID UPTAKE BY THE ISOLATED RAT LIVER. R. W. Brauer, R. J. Holloway, and G. F. Leong. Sept. 20, 1956. 20p. Project NM 006-015.04.

1763
DISTRIBUTION IN THE SOFT TISSUE OF THE RAT OF RADIOACTIVE FLUORIDE ADMINISTERED AS SODIUM FLUORIDE. John W. Hein (Colgate-Palmolive Co., Jersey City, N. J.); John F. Bonner (Div. of Biology and Medicine, AEC, Washington, D. C.); Finn Brudevold (Eastman Dental Dispensary, Rochester, N. Y.) and Frank A. Smith and Harold C. Hodge (School of Medicine and Dentistry, Univ. of Rochester, N. Y.). Nature 178, 1295-6(1956) Dec. 8.

CHEMISTRY

1764 AECU-3372
Michigan. Univ., Ann Arbor.
TEMPERATURE DEPENDENCE OF SILVER-SILVER CHLORIDE EXCHANGE. T. W. Olcott. Oct. 12, 1956. 24p. Project No. 7. Contract AT(11-1)-70. $0.25(OTS).

The temperature dependence of the Ag-AgCl exchange has been studied at 2, 26, 38, 53, 64, 74, 84, and 96°C using radioactive Ag^{110}. The AgCl is present as a thin coating on a Pt gauze electrode. The preparation of the electrode, the exchange procedure, the results of the experiments and the errors inherent in the method used are discussed in detail. (auth)

1765 NP-6157
Iowa State College, Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Quarterly Progress Report [for] August 15, 1956 to November 15, 1956. Henry Gilman. 28p. Contract AF-33(616)-3510.

The development of new synthetic procedures for the preparation of custom-made organogermanium compounds is presented. One of the more attractive types for this purpose is R_3GeM where the R group is alkyl or aralkyl. It is established that a compound like triethylgermyllithium can be prepared by a reaction between triethylgermane and n-butyllithium. In extending the preparation of the promising cyclic-organo-silicon compounds (like the dibenzosilole types) it has been observed that spiro-5,5'-bis-dibenzosilole is formed in the reaction of 2,2'-dilithiobiphenyl with each of the following: hexachlorodisilane, methyltrichlorosilane, and n-dodecyltrichlorosilane. In this connection there is a two-fold interest in the reaction of ortho-dihaloaryl compounds with metals and organometallic compounds. One is the introduction of the significant haloaryl group; and the other is a new use of this reaction for

the convenient preparation of the necessary 2,2'-dibromobiphenyl. In reactions between ortho-dihalobenzenes and an RLi compound, the "benzyne" intermediate is formed in good yields and should prove useful in the synthesis of new R_4Si and R_4Ge compounds. Directions are given for the synthesis of tris-beta-phenyl-ethylsilane and tris-gamma-phenylpropylsilane. These compounds provide an essential means for the introduction of aralkyl groups which impart desirable characteristics. (auth)

1766 AEC-tr-2670

CONTRIBUTION TO THE STUDY OF THE REACTIONS BETWEEN GASES AND SOLIDS. II. SULFATE-FORMING OXIDATION OF PRECIPITATED SULFIDES. J. Lemmerling and A. Van Tiggelen. Translated from Bull. soc. chim. Belges 64, 470-83(1955). 14p.

It was shown that CuS, CoS, NiS, and ZnS, prepared by precipitation, react with O_2 in the temperature range of 150 to 300°C, to yield only the corresponding sulfates. The reaction rate is indicated by the relationship $V = k(O_2)/1 + k'(O_2)$ where (O_2) is actual O_2 pressure and k, and k, are rate constants. This equation may be derived from a reaction mechanism which is based essentially on the adsorption and activation of O_2 on the surface of the sulfide. The activation energies of the different reactions were measured: they differed only very slightly among themselves, for the four metals studied. (auth)

1767

THERMODYNAMIC THEORY OF IRREVERSIBLE PROCESSES. III. THE POTENTIALS OF ELECTROCHEMICAL CELLS IN GRAVITATIONAL AND CENTRIFUGAL FIELDS. Donald G. Miller (Brookhaven National Lab., Upton, N. Y.). Am. J. Phys. 24, 595-604(1956) Dec.

Using the thermodynamic theory of irreversible processes, a general equation is derived for the solution potential of a multicomponent fluid containing both charged and uncharged species situated in a gravitational or centrifugal field. The argument fully takes into account the irreversible processes of sedimentation and diffusion, and it is shown rigorously how the Hittorf transference numbers of ions and nonelectrolytes enter into the expression. The cell emf is derived and specialized for three cases of experimental interest; the concentration cell with transference, the homogeneous solution in the field cell, and the sedimentation equilibrium cell. These equations are applied to three common electrode systems with a single binary electrolyte in a single neutral solvent. (auth)

1768

POLYMERIZATION OF VINYL ACETATE BY HIGH ENERGY RADIATION. Seizo Okamura, Takao Yamashita and Toshinobu Higashimura (Department of Textile-chemistry, Faculty of Engineering, Kyoto Univ., Japan). Bull. Chem. Soc. Japan 29, 647-8(1956) Aug.

1769

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ELECTRON TRANSPORT IN METALS AND SOLIDS, HELD AT THE NATIONAL RESEARCH LABORATORIES, OTTAWA, SEPTEMBER 10-14, 1956. Can. J. Phys. 34, No. 12A, 1171-1423(1956) Dec.

1770

CONSTITUTIONAL DIAGRAMS OF Na, K||Cl, WO_4. G. Bukhalova and Z. Mateiko (Rostov-on-Don Construction Inst.). Zhur. Obshchei Khim. 26, 2119-24(1956) Aug. (In Russian)

Composition diagrams of Na, K||Cl, WO_4 melting points consisting of seven fields of crystallization converging in five non-variant points, three of which are eutectic, were investigated. Complex 2 $Na_2WO_4.Na_2Cl_2$ is polar to the four-prong triangulation star, consequently, the crystallization trunk has a linear-elongated shape. The two complexes appearing between the sodium and potassium tunstates are expressed by specific fields, whereupon the complex $Na_2WO_4.K_2WO_4$, in the binary system, melts with decomposition, while within the intersystem limits, it melts without decomposition. (R.V.J.)

AEROSOLS

1771

THE GENERATION OF A SOLID SUB-MICRON TEST AEROSOL. H. Glauberman and A. J. Breslin (Industrial Hygiene Branch, AEC, New York). Am. Ind. Hyg. Assoc. Quart. 17, 401-4(1956) Dec.

An aerosol generator has been devised which produces a uranium fume of controllable concentration and reproducible size spectrum for a sustained period. The fume is emitted from uranium chips burned in an argon and oxygen gas stream. To achieve uniformity in burning, new metal surfaces are continuously presented by slowly moving the chips through the gas stream on a wire mesh bed rotated by a slow-speed motor. It has been demonstrated that the median particle size can be pre-selected for any given run over the range of 0.05 μ (σ_g = 2.5) to 0.2 μ (σ_g = 3.1) by establishing the appropriate argon to oxygen ratio and total gas flow-rate. The unit serves as a standard test-aerosol generator for filter efficiency measurement. (auth)

ANALYTICAL PROCEDURES

1772 A-2912(Vol. II, Pt. 1)

Madison Square Area, Manhattan District, New York.
MANUAL OF ANALYTICAL METHODS. VOLUME II. PART 1. ANALYSIS OF REFINED MATERIALS AND BY-PRODUCTS. Lewis G. Bassett, Daniel J. Pflaum, Robert J. Rutman, Clement J. Rodden, and N. H. Furman, comps. Jan. 1946. Decl. June 21, 1956. 154p. $0.85(OTS).

Analytical methods are presented for the determination of: U in tails, cakes, and recovery process materials, as in black oxides, B in slags and residues, Cd in black oxides, Cl in black oxides and soda salts, Cu in black oxides and UO_4, and F in oxides, peroxides and slags. (W.L.H.)

1773 CF-55-10-38

Oak Ridge National Lab., Tenn.
INVESTIGATION OF THE CHRONOPOTENTIOMETRIC METHOD OF ANALYSIS. D. J. Fisher. Oct. 13, 1955. Decl. Jan. 19, 1956. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In the chronopotentiometric technique, the concentration of a particular ion is determined by measuring the time lag in polarizing a quiet Hg pool cathode when the electrolyzing current through the solution is constant. The limitations of the method are determined by various factors in cell design. The results of studies of these factors are discussed. (T.R.H.)

1774 KAPL-M-JR-8

Knolls Atomic Power Lab., Schenectady, N. Y.
CHEMICAL DETERMINATION OF BORON IN 7% URANIUM–ZIRCONIUM AND 7% URANIUM–ZIRCALOY. J. Rynasiewicz and Vivian F. Consalvo. Aug. 31, 1956. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A procedure has been developed for the analysis of B in 7% U–Zr alloys containing approximately 0.015% B. Fine metal chips from the alloy were fused with Na_2CO_3. The melt was dissolved in H_2O, and then made slightly acid. The solution was made slightly alkaline, filtered, and evaporated to dryness. The B was leached from a slurry of the salt using 95% ethyl alcohol and then determined colorimetrically by the curcumin method. (auth)

1775 MLM-986
Mound Lab., Miamisburg, Ohio.
ANALYSIS OF MASSIVE AMOUNTS OF PLATINUM FOR TRACER AMOUNTS OF RADIOACTIVITY. M. L. Curtis and R. A. Staniforth. June 23, 1954. 5p. Contract AT-33-1-GEN-53. $1.80(ph OTS); $1.80(mf OTS).

A thick sample alpha counting technique has been adapted to determine tracer amounts of radioisotopes in massive amounts of material. The procedure was used to determine polonium in new and decontaminated platinum. The ratio of weight of polonium to weight of platinum and the disintegration rate of polonium per gram of platinum was determined for each of 6 samples. The probable errors of the determinations ranged from ± 20% for new platinum to ± 3.5% for a sample containing approximately 2 atoms of polonium per 1×10^{12} atoms of platinum. (auth)

1776 ORNL-2226
Oak Ridge National Lab., Tenn.
STUDY IN ACTIVATION ANALYSIS. W. A. Brooksbank, Jr. Dec. 18, 1956. 71p. Contract W-7405-eng-26. $0.45(OTS).

The principles of the activation analysis technique are given, and sensitivity and errors are described. The procedure is outlined and experimental results given for determinations of Cu, Mn, Ni, Fe, Zn, and Ti in Al alloys. (T.R.H.)

1777 UCRL-3500
California. Univ., Berkeley. Radiation Lab.
SERUM LIPIDE ANALYSIS BY CHROMATOGRAPHY AND INFRARED SPECTROPHOTOMETRY. Norman K. Freeman, Frank T. Lindgren, Yook C. Ng, and Alex V. Nichols. Aug. 23, 1956. 24p. Contract W-7405-eng-48. $0.25 (OTS).

1778
DIRECT DETERMINATION OF C^{14} AND S^{35} IN BLOOD. William W. Burr, Jr. and Donald S. Wiggans (Univ. of Texas, Dallas). J. Lab. Clin. Med. 48, 907-11(1956) Dec.

A direct mounting procedure suitable for radioactive assay of small blood samples has been described in detail and its reproducibility evaluated. Results obtained with this technique have been related to oxidative methods. The procedure has been extended to include samples in which both S^{35} and C^{14} are present. The basis of the counting schedule employed and the calculations required for determining the percentage of the activity contributed by each of the isotopes are discussed. (auth)

1779
THE DETERMINATION OF MANGANESE IN BIOLOGICAL MATERIAL BY ACTIVATION ANALYSIS, WITH A NOTE ON THE GAMMA SPECTRUM OF BLOOD. H. J. M. Bowen (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 3, 18-24(1956) Aug.

A method is described for the determination of Mn in biological material using the technique of activation analysis. The limit of detection of the method is 0.1 mμg. Human blood contains about 2.4μg of manganese per 100 ml, and the element is about equally distributed between cells and serum. Part of the γ spectrum of neutron-activated blood is described, and it is suggested that γ spectroscopy could be used for routine measurements of sodium and chlorine in blood. (auth)

1780
THE FLAME PHOTOMETRIC DETERMINATION OF LITHIUM USING INFRA-RED BARRIER LAYER CELLS. H. J. Allsopp and P. M. Wingfield (Royal Aircraft Establishment, Farnborough). Metallurgia 54, 255-9(1956) Nov.

Lithium is determined using potassium as an internal standard with a town-gas and air flame. The paper describes a double-beam instrument modified to incorporate infra-red barrier-layer cells which have peak response in the region of the lithium and potassium major lines. Long-term stability tests on the photocells were carried out and the effects of alloying constituents and acidity in the final solution have been studied. A method for determining lithium-zinc alloys is given. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1781 UCRL-3521
California. Univ., Berkeley. Radiation Lab.
THE CRYSTAL STRUCTURES OF TRIAZOLE AND CHOLINE CHLORIDE (thesis). Michael E. Senko. Sept. 1956. 47p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The x-ray crystal structure of the heterocyclic 3-hydrazino, 5-thiol, 1,2,4-triazole was determined by a combination of Fourier and least-squares methods. The most unusual feature of the structure is the appearance of a short nitrogen-nitrogen hydrogen bond whose length is 2.88 A. The packing of the molecules appears to be controlled predominantly by this bond as a possible sulfur-nitrogen ionic bond. These two bonds connect individual molecules together and cause them to form endless sheets through the crystal. The five-membered ring was found to be planar within the experimental error of the determination. The second structure, that of choline chloride, was also refined by Fourier and least-squares methods. Interest in this compound stems from its sensitivity to high energy β or γ radiation. The structure provides no immediate explanation for this sensitivity, but it does have two interesting features. First, there is no formation of expected oxygen-oxygen hydrogen bonds; instead oxygen-chloride hydrogen bonds are formed. Second, the packing of the molecules seems to be controlled by electrostatic interactions between the quaternary and the chloride atoms. A lengthening of the carbon-nitrogen bonds also occurs, but this effect is less than the experimental error in the determination. (auth)

1782 UCRL-4745
California. Univ., Livermore. Radiation Lab.
THE CRYSTAL STRUCTURE OF TETRA-n-PROPYL AMMONIUM BROMIDE. Allan Zalkin. Oct. 1956. 16p. Contract W-7405-eng-48. $0.20(OTS).

Tetra-n-propyl ammonium bromide crystallizes in the tetragonal space group $I\bar{4}$. The cell constants are a = 8.24A and c = 10.92A with two molecules per unit cell. The ions pack in the cubic ZnS-type arrangement, where each Br^- ion is surrounded by a tetrahedron of $(n\text{-}C_3H_7)_4N^+$ ions and vice versa. The carbons and nitrogen are clearly resolved in a Fourier projection on the (001) plane, and the parameters of these atoms were refined by a least-squares treatment of the three-dimensional data. Bond distances were calculated giving two carbon-carbon bonds of 1.56 and 1.54 A and a carbon-nitrogen bond length of 1.55A. (auth)

1783
STRUCTURE AND CRYSTALLIZATION OF NEARLY AMORPHOUS BERYLLIUM OXIDE AND ALUMINIUM OXIDE FILMS. I. S. Kerr (Imperial Coll., London). Acta. Cryst. 9, 879-85(1956) Nov.

Two methods of preparing BeO films suitable for electron-diffraction examination are described. These films gave a halo diffraction pattern differing appreciably from that corresponding to a broadened ring pattern from normal hexagonal BeO. The crystallization of this form of the oxide was shown to occur at 300° C. by heating in air. Calculation showed that the halo pattern originated from diffraction by BeO crystals of normal structure, but the crystals were only 8 A in diameter. The oxide film partially stripped from anodized Al was examined by electron diffraction, and haloes

were obtained similar to those reported previously. This film was found to crystallize into γ-Al_2O_3 after heating to 700° C. for 7 hr in air. The possible structure of the nearly amorphous oxide is discussed and the model suggested by Wilsdorf is shown to be likely. (auth)

1784

A SET OF EFFECTIVE COORDINATION NUMBER (12) RADII FOR THE β-WOLFRAM STRUCTURE ELEMENTS. S. Geller (Bell Telephone Labs., Inc., Murray Hill, N. J.). Acta Cryst. 9, 885-9(1956) Nov.

1785

THE CRYSTAL STRUCTURE OF $Ce(IO_3)_4$. Don T. Cromer and Allen C. Larson (Los Alamos Scientific Lab., New Mexico). Acta Cryst. 9, 1015-18(1956) Dec.

The crystal structure of $Ce(IO_3)_4$ has been determined by single-crystal methods. Refinement of the structure was made by the method of least squares. $Ce(IO_3)_4$ is tetragonal, space group $P4_2/n$, with a = 9.90 and c = 5.32 A. The cerium atoms are surrounded by eight oxygens at the corners of a distorted Archimedes antiprism. Two of the three oxygens in each iodate group are coordinated to cerium while the third oxygen is isolated. The three I–O bond lengths are 1.78, 1.84, and 1.83 A, all ±0.09 A. The average Ce–O distance is 2.33 A. Within the limits of error, the iodate group has trigonal symmetry. Each iodine atom has five oxygen neighbors in addition to the three in the iodate group. (auth)

1786

THE EXISTENCE OF Cs_2PoI_6 COMPOUND. Olga M. Janković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 143-7(1956) Mar.

The existence of Cs_2PoI_6 was established by making a fast crystallization and using Te as carrier. (auth)

1787

THE CRYSTAL STRUCTURE OF CESIUM HEXAIODOTELLURITE. Ljubica M. Manojlović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 149-52(1956) Mar.

The structure of Cs_2TeI_6 has been determined from X-ray powder photographs. It was found that it has a cubic, face-centered crystal lattice which belongs to space group O_h^5-Fm3m. The iodine atoms are placed in positions with parameter $x = 0.250$. The unit cell constant is equal to a = 11.700 ± 0.004 A. There are four molecules per unit cell. X-ray calculated density is 4.83 g/cm^3. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

1788 A-718

Columbia Univ., New York. Div. of War Research.
THE OPERATION OF A DUAL-TEMPERATURE SINGLE STAGE TOWER FOR DEUTERIUM CONCENTRATION. M. L. Eidinoff and C. F. Hiskey. May 28, 1943. Decl. Nov. 1, 1956. 16p. Contract W-7405-eng-50. (2DR-28). $3.30(ph OTS); $2.40(mf OTS).

An all glass unit simulating the operation of a proposed S-Process plant has been constructed and operated. In this process water flows successively through a cold tower and through a hot tower, and then is eliminated as waste. Hydrogen sulfide gas is recycled in these two towers counter current to the water flow. The course of the gas is first through the hot tower, then through coolers, then into the cold tower, and finally to a blower which feeds it back into the hot tower. The process utilizes the fact that the equilibrium constant of the exchange reaction $HDS + H_2O \rightleftharpoons H_2S + HDO$ varies with temperature, being less at the higher temperatures. The rate of exchange between the H_2S gas and that of the water is extremely rapid, and thus in normal operation the enriched product concentrates between the hot and cold towers. From here it may be drawn off as product, or sent to a second stage where it may be concentrated to a greater degree. (auth)

1789 NBS-4674

National Bureau of Standards, Washington, D. C.
A REVIEW OF THE REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. V. ASSOCIATION-ADDITION AND ELIMINATION REACTIONS. Lawrence M. Brown. June 15, 1956. 27p. Project 0302-10-2641. $0.25(OTS).

A review of the literature on the kinetics of association–addition and elimination reactions of deuterium compounds has been prepared. The experimental data are summarized. (auth)

1790

ISOTOPIC EFFECT IN THE LIQUID-VAPOR EQUILIBRIUM OF BINARY SYSTEMS CONTAINING DETERIUM COMPOUNDS. I. B. Rabinovich, P. N. Nikolaev, Z. E. Gochaliev, and N. N. Tretyakova (Lobachevskiĭ Gorkiĭ State Univ.) Doklady Akad. Nauk S.S.S.R. 110, 241-4(1956) Sept. 11. (In Russian)

1791

PREPARATION AND DOSAGE, WITH CONCENTRATION TO WITHIN 0.1%, OF SOLUTIONS OF DEUTERATED BORIC ACID IN HEAVY WATER. Cécile Finck, Romain Kleinberger, Francois-Michel Lang, Pierre Magnier, and Pierre Perio (Commissariat a l'Énergie Atomique, Paris). J. Nuclear Energy 3, 25-7(1956) Aug. (In French)

Solutions of deuterated boric acid in heavy water have been prepared with concentrations known to within 0.1%. They were made from very pure boric anhydride, obtained by dehydrating boric acid, using a vacuum thermobalance (Eyruad type). The solutions are analyzed by weighing calcium borate. (auth)

1792

HYDROGEN EXCHANGE BETWEEN AROMATIC HYDROCARBONS AND LIQUID DEUTERIUM BROMIDE. A. I. Shatenshteĭn, V. R. Kalinachenko, and Ya. M. Varshavskiĭ (Karpov Moscow Inst. of Physical Chemistry.). Zhur. Fiz. Khim. 30, 2093-7(1956) Sept. (In Russian)

The rate of hydrogen exchange between liquid deuterium bromide and aromatic hydrocarbons with both condensed and linearly connected rings (benzene, naphthalene, anthracene, phenanthrene, pyrene, diphenyl, p-terphenyl) has been measured. The results were compared with data on hydrogen exchange with liquid deuteroammonia catalyzed by potassium amide. (tr-auth)

1793

HYDROGEN EXCHANGE BETWEEN BENZENE AND NAPHTHALENE DERIVATIVES AND LIQUID DEUTERIUM BROMIDE. A. I. Shatenshteĭn, V. R. Kalinachenko, and Ya. M. Varshavskiĭ (Karpov Moscow Inst. of Physical-Chemistry). Zhur. Fiz. Khim. 30, 2098-2105(1956) Sept. (In Russian)

The rate of hydrogen exchange between benzene and naphthalene derivatives and DBr has been measured to determine the effect of substitutes (CH_3, NO_2, CN, COOH, Cl, Br) on the reactivity of aromatic compounds in electrophilic hydrogen substitution reactions. Rates of exchange of the unequivalent types of hydrogen in the monoalkyl benzenes (CH_3, C_2H_5, iso-C_2H_7, t-C_4H_9, and n-C_4H_9) were compared and the effects produced by alkyl group branching and by the second reagent on the reactivity were discussed. The isotopic hydrogen exchange in polymethylbenzenes (m-xylene, mesitylene, durene, penta- and hexabenzene) was also considered. (tr-auth)

FLUORINE AND FLUORINE COMPOUNDS

1794 ORNL-2038

Oak Ridge National Lab., Tenn.
A COMBINED DISTILLATION-ELECTROCHEMICAL

METHOD FOR RECOVERY OF HYDROFLUORIC ACID. J. A. Marinsky and A. J. Giuffrida. May 25, 1956. Decl. Sept. 6, 1956. Contract W-7405-ENG-26. $0.30(OTS).

Electrodialysis in an ion-exchange membrane cell was shown to be technically feasible for the concentration of an azeotropic mixture of HF and water. A flowsheet is presented for recovery of anhydrous HF by distillation and electrodialysis of the azeotropic residue. In the electrodialysis step, 2.6 kwhr of energy per pound of anhydrous product was consumed. With electricity at 1¢ per kilowatt-hour, the total operating cost of the electrodialysis equipment alone, including amortization, would be 6¢ per pound of HF. (auth)

GRAPHITE

1795 AECD-3759

Great Lakes Carbon Corp., Morganton, N. C. and Great Lakes Carbon Corp., Morton Grove, Ill.

F PROCESS. Final Report. P. W. Leppla and R. F. Markel. Mar. 15, 1951. Changed from OFFICIAL USE ONLY with deletions Oct. 10, 1956. 94p. Contract AT (45-1)-269. $16.80(ph OTS); $5.70(mf OTS).

The ability to make and purify nuclear reactor-grade carbon on a commercial scale was demonstrated. Results of a survey demonstrated that there are at least thirteen petroleum cokes produced commercially in the United States that are purifiable to acceptable standards for nuclear reactor use. (C.H.)

1796

OBSERVED DEPENDENCE OF THE LOW-TEMPERATURE THERMAL AND ELECTRICAL CONDUCTIVITY OF GRAPHITE ON TEMPERATURE, TYPE, NEUTRON IRRADIATION, AND BROMINATION. Alan W. Smith and Ned S. Rasor (Atomics International, Canoga Park, Calif.). Phys. Rev. 104, 885-91(1956) Nov. 15.

The thermal conductivity of various graphites in the temperature interval 10 to 300°K has been determined and the effect of neutron irradiation and bromination investigated. The thermal conductivity of large crystallite natural graphite and of nonpitch-bonded graphite is found to vary as T^2 at low temperatures, as does the specific heat, in accordance with the simple theory of lattice heat conduction. This is in contrast to the anomalous $T^{2.7}$ dependence exhibited by various pitch-bonded graphites. The anomaly is explained in a subsequent paper in terms of the effect of ungraphitized pitch on the total thermal resistivity of pitch-bonded graphites. Neutron irradiation is observed to cause the thermal conductivity of graphite to decrease markedly at a rate which decreases with exposure time. Also, the exponent of the temperature dependence decreases with exposure. The effect of bromination on the thermal conductivity of graphite is determined and compared with the effect of neutron irradiation. The results indicate that the change in the concentration of conduction electrons is not the principal mechanism by which neutron irradiation decreases the thermal conductivity. The electrical resistivity shows a negative temperature coefficient for all graphites, except the large crystallite natural graphite. Neutron irradiation increases the electrical resistivity to a saturation value and decreases the magnitude of the temperature coefficient. (auth)

1797

INTERPRETATION OF THE LOW-TEMPERATURE THERMAL CONDUCTIVITY OF GRAPHITE. John E. Hove and Alan W. Smith (Atomics International, Canoga Park, Calif.). Phys. Rev. 104, 892-900(1956) Nov. 15.

The experimental data observed by Smith and Rasor in measuring the low-temperature thermal conductivity of several types of graphites are interpreted on the basis of a two-medium theory. The theory assumes that, in the artificial polycrystalline graphites, the nongraphitic regions are isotropic thermal conductors and that these regions can be taken in series with the graphite particles to obtain a total conductivity. In this way, the anomalous temperature dependence of the artificial graphites can be immediately explained. Using this theory as a guide, the crystallite size of a given sample can be found in an unambiguous manner, and for the various graphite types discussed by Smith and Rasor are found to correlate with independent previous estimates. Furthermore, the observed effects of neutron damage and bromination can be readily explained in a phenomenological manner. Although this theory still needs refining in several aspects, it appears to be substantiated by all the available evidence and helps to establish the usefulness of low-temperature thermal conductivity measurements as a probe to detect internal defects and microstructure in graphite. (auth)

LABORATORIES AND EQUIPMENT

1798

ON SOME PROBLEMS OF TECHNIQUES IN RADIOCHEMICAL EXPERIMENTS. A. A. Goryunov (Novocherkassk Hydrochemical Inst.). Zhur. Analit. Khim. 11, 590-9(1956) Sept.-Oct. (In Russian)

A number of improved auxiliary devices are offered for use in radiochemical experiments. Descriptions include an improved protective housing for the end-window counter; a vertical casing for the aluminum absorbers; celluloid plates; pressforms and a heater for celluloid plate molding; and, an evaporator for drying radioactive samples. (R.V.J.)

Refer also to abstract 1827.

MOLECULAR STRUCTURE

Refer to abstract 1836.

RADIATION CHEMISTRY

1799 ORNL-2208

Oak Ridge National Lab., Tenn.

RADIATION INDUCED NITRITE FORMATION FROM CONCENTRATED NITRATE SOLUTIONS. Harvey A. Mahlman. Dec. 3, 1956. 48p. Contract W-7405-eng-26. $0.35(OTS).

Experiments were performed to measure the rate of NO_2^- production when solutions of metal nitrates were irradiated. An analysis of all data showed that the yield of NO_2^- produced by direct action was independent of the cation, dependent only upon the NO_2^- concentration, and dependent upon the total absorbed energy regardless of the particular constituents of the solution. (W.L.H.)

1800

THE ROLE OF CHEMISTRY IN A NUCLEAR ENERGY PROJECT. R. Spence (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys., Suppl. No. 5, 88-91(1956).

The development of atomic energy has been unique from a chemical point of view, in that a whole series of new elements, the actinide series, has been produced and some of these, such as neptunium, plutonium, and americium, play a major role in the technology. Furthermore, many elements which were previously little known and of academic interest only, have become of technical importance in the project, as for example, ruthenium, zirconium, and protactinium. Atomic energy can be divided into the following broad fields, from the chemical point of view, viz., raw

materials; production of fuel elements and other special reactor materials; reactor chemistry; chemical processing of irradiated materials; disposal and utilization of radioactive waste materials. Although the provision of materials and the processing of irradiated fuel elements are of great importance, the nuclear reactor itself has always been the centre of interest. The earlier forms of reactor did not in themselves present any very serious chemical problems. Newer forms of reactor, however, operate at high temperatures and frequently bear more resemblance to chemical or metallurgical plants than they do to mechanical apparatus. (auth)

1801

OXIDATION OF FERROUS SULFATE BY IONIZING RADIATIONS FROM (n,α) REACTIONS OF BORON AND LITHIUM. Robert H. Schuler and Nathaniel F. Barr (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 78, 5756-62(1956) Nov. 20.

The respective 100 ev yields for oxidation of ferrous ion by these radiations have been found to be 4.22 ± 0.08 and 5.69 ± 0.12 for 1 mM ferrous sulfate in aerated 0.8 N sulfuric acid solution and 3.77 ± 0.10 and 4.10 ± 0.10 in deaerated solution. From the above values, a yield of 6.7 in aerated solutions is estimated for the 2.7 Mev tritium recoil produced in the neutron activation of lithium. The yields of ferric ion are increased slightly by saturating the solutions with oxygen and also by increasing the concentration ferrous sulfate from 1 to 10 mM. (auth)

1802

USE OF IRRADIATED POLYMERS AS INITIATORS OF POLYMERIZATIONS. J. C. Bevington and D. E. Eaves (Univ. of Birmingham, England). Nature 178, 1112-13(1956) Nov. 17.

1803

EFFECTS OF THE Co^{60} γ EMISSION ON CONCENTRATED POTASSIUM CHLORIDE AQUEOUS SOLUTIONS. A. M. Kabakchi (Moscow Inst. of Physical Chemistry). Zhur. Fiz. Khim. 30, 1906-7(1956) Aug. (In Russian)

Aqueous solutions thrice distilled and chemically pure KCl thrice recrystallized and annealed at 650 to 700° were used in the experiment. All experiments were made in pH solutions of 11 + 0.15. Co^{60} was used as the source, with γ emission of 2.7×10^{16} ev/ml per min. The Compton effect and the absorption energy proportional to the total number of electrons were calculated. A diagram is given comparing the values of the yield of radiochlorine to the electrons per chlorine ion in KCl solutions saturated with oxygen, air, and nitrogen. (R.V.J.)

RADIATION EFFECTS

1804 HW-42947

Hanford Atomic Products Operation, Richland, Wash.

PLASTICS AND ELASTOMERS IN RADIATION FIELDS: A PRELIMINARY EVALUATION. Robert Harrington. May 4, 1956. Decl. June 6, 1956. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The effects of 2 different environmental conditions on plastics and elastomers are compared. The effect of 10^7 to 10^8 r of gamma radiation on weight, thickness, hardness, and elasticity is compared to the effect of water at 145°C and 60 psi on fluorocarbons, silicones, chloroprenes, chlorosulfonated polyethylene, and Buna N. (T.R.H.)

1805 USNRDL-TR-110

Naval Radiological Defense Lab., San Francisco.

RADIATION-INDUCED ELECTRONIC PROCESSES IN SIMPLE ORGANIC MATERIALS. R. S. Alger and T. H. Anderson. Sept. 13, 1956. 40p. Projects NS 081-001 and NE 051-551.

The electronic processes in irradiated solid methanol, ethanol, and acetone have been studied by means of absorption and emission spectroscopy, photo-conductivity, and electron paramagnetic resonance in order to obtain a better understanding of the electron trapping process and the nature of the products of ionization in organic dielectrics. At liquid nitrogen temperatures, the color centers formed in these materials by electron or X-ray bombardment are quite stable. However, the centers are photosensitive to light in the visible region and can be bleached both optically and thermally. The conductivity measurements indicate the prevalence of electron traps but a lack of any photocurrent that could be related to the color centers. Relationships between color centers and thermoluminescence on electron spin resonance are examined. Hyperfine splitting due to proton interactions in the radicals was observed in all cases. (auth)

1806

OXIDATION OF TELLUROUS ACID IN AQUEOUS SOLUTION BY γ RAYS. M. Haissinsky and A. S. Ghosh-Mazumdar (Institut du Radium, Paris). J. chim. phys. 53, 782-3(1956) Sept. (In French)

1807

THE PROTECTIVE EFFECT OF SOME SUBSTANCES IN THE IRRADIATION OF PROTEIN SOLUTIONS. T. E. Pavlovskaya and A. G. Pasynskiĭ (Bakh Moscow Inst. of Biochemistry). Kolloid Zhur. 18, 583-8(1956) Sept.-Oct. (In Russian)

By direct measurements of sulfhydril group content in crystalline egg albumen it was revealed that the oxidation of these groups by x rays proceeds with an ionic yield 1 and by ultraviolet rays with a guantum yield of 2×10^{-3}. In the presence of cysteine or ascorbic acid the groups are protected from oxidation while in the presence of thiourea the protective action was not present. With the above mentioned systems and the systems of catalase-pyruvic acid and glucose-methylene blue, the ratio of statistical concentration and chemical factors in the protective action has been calculated for various organic substances and a method has been proposed for quantitative determination of their protective capacities. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1808 ISC-671

Ames Lab., Ames, Iowa.

KINETICS OF THE EXCHANGE REACTION BETWEEN TWO OXIDATION STATES OF CERIUM. Frank R. Parchen, Jr., and F. R. Duke. Mar. 1955. 40p. Contract W-7405-eng-82. $0.30(OTS).

The kinetics of the exchange of Ce^{3+} and Ce^{4+} in $HClO_4$ was studied using TBP to separate the reactants. The rate was first order with respect to Ce^{3+} and first and second with respect to Ce^{4+} in 5 to 6 F $HClO_4$. The reaction was not catalyzed by Pt, platinized Pt, light, glass, polyethylene, or O_2. (T.R.H.)

SEPARATION PROCEDURES

1809 AECU-3367

Bureau of Mines. Intermountain Experiment Station, Salt Lake City.

INNOVATIONS IN PROCESSING URANIUM ORES. J. B. Rosenbaum, J. B. Clemmer, and W. L. Lennemann. Sept. 1956. 22p. (RR-46.1).

1810 ISC-760

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN

ENGINEERING FOR JANUARY–JUNE 1956. Oct. 4, 1956. 21p. Contract W-7405-eng-82. $0.20(OTS).

1811 ISC-793
Ames Lab., Ames, Iowa.
SEPARATION OF NIOBIUM AND TANTALUM; A LITERATURE SURVEY. Ernest L. Koerner and Morton Smutz. Aug. 15, 1956. 14p. Contract W-7405-eng-82. $0.15 (OTS).

1812 NYO-1145
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 11 [for] March 1952. July 1952. Decl. Nov. 13, 1956. 14p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

Continuous precipitation with dilute NH_4OH from the HCl digest liquor of mixtures calcined liner materials gave too high F levels. The effects of $AlCl_3$ addition prior to precipitation and of increased precipitation and calcination temperatures on the F level were studied. Data were obtained on the ratio of NH_4OH to acid filtrate necessary for continuous precipitation. Precipitation of $UO_2NH_4PO_4$ was found to be satisfactory with respect to U and F levels for only certain liner and scrap digest liquors. Preliminary experiments were carried out on digestion and purification of various carbonate residues, particularly those resulting from Belgian Congo pitchblende ores. Sizing experiments on the efficiency of production milling of liner materials indicated little or no control over particle size of the feed material. Additional pilot-plant data on water leaching, calcination, and digestion of bronze flux cake were obtained. (J.E.D.)

1813 NYO-1146
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 12 [for] April 1952. May 20, 1952. Decl. Nov. 13, 1956. 12p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

1814 NYO-1147
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 13 [for] May 1952. A. J. Strod. June 20, 1952. Decl. Nov. 13, 1956. 9p. Contract AT(30-1)-1241. $1.80(ph OTS); $1.80(mf OTS).

Investigation of the applicability of various procedures for the treatment and digestion of carbonate and other uraniferous residues for the recovery of U is presented. (J.E.D.)

1815 NYO-1148
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 14 [for] July 1952. H. Fleck and John Summers. July 23, 1952. Decl. Nov. 13, 1956. 10p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

Experiments employing the direct Na_2CO_3 leach and digestion under low pressures indicate that Vitro pitchblende carbonate residues will not satisfactorily adapt to this treatment. Experiments using mineral acid digestive procedures indicate that H_2SO_4 is not effective in solubilizing contained U values from pitchblende residues. An HCl treatment is indicated to be effective in solubilizing U values from these residues on a quantitative basis. Extraction with solubilized U values by means of reprecipitation of the R_2O_3 elements with Na_2CO_3 has been only partially successful. Preliminary experiments indicate that calcination of residues resulting from current production at temperatures in excess of 1200°F followed by HCl digestion will result in dissolution of U contained in these residues on a quantitative basis. Complete pilot level experiments indicate that the elevation of digest pressures to 65 psig will not substantially beneficiate the extraction of U from BFC-6 residues. (J.E.D.)

1816 NYO-1151
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 17 [for] September 1952. H. Fleck and John E. Summers. Oct. 15, 1952. Decl. Nov. 13, 1956. 23p. Contract AT(30-1)-1241. $4.80(ph OTS); $2.70(mf OTS).

The extraction of U as uranyl ammonium phosphate from Vitro Na_2CO_3 process residues and as a soluble carbonate from ammonium salts precipitated from the digest liquor of Na_2CO_3 process residues is reported. (J.E.D.)

1817 NYO-1152
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 18 [for] October 1952. H. Fleck and J[ohn] E. Summers. Nov. 15, 1952. Decl. Nov. 13, 1956. 28p. Contract AT(30-1)-1241. $4.80(ph OTS); $2.70 (mf OTS).

The recovery of U by the digestion and refining of C-slags and other residues, refining of BFC-6, and the refining and processing of Vitro Na_2CO_3 residues is reported. (J.E.D.)

1818 NYO-1153
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 19 [for] November 1952. H. Fleck and J[ohn] E. Summers. Dec. 17, 1952. Decl. Nov. 13, 1956. 21p. Contract AT(30-1)-1241. $4.80(ph OTS); $2.70(mf OTS).

The progress of the work on the digestion and refining of C-slags and other residues and processing of Na_2CO_3 residues for U recovery is reviewed. (J.E.D.)

1819 NYO-1154
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 20 [for] December 1952. H. Fleck and J[ohn] E. Summers. Jan. 15, 1953. Decl. Nov. 13, 1956. 21p. Contract AT(30-1)-1241. $4.80(ph OTS); $2.70(mf OTS).

The applicability and refinement of various procedures for the treatment and digestion of C-slags and other uraniferous residues for recovery of U values with a minimum of change of equipment are discussed. Methods of recovery of U from various residues, resulting from Na_2CO_3 digestion of U-bearing materials, to reduce the U content of the residues below 0.05% are reported. (J.E.D.)

1820 NYO-1155
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 21 [for] January 1953. H. Fleck and J[ohn] E. Summers. Feb. 14, 1953. Decl. Nov. 13, 1956. 20p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40 (mf OTS).

1821 NYO-1156
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 22 [for] February 1953. H. Fleck and J[ohn] E. Summers. Mar. 16, 1953. Decl. Nov. 13, 1956. 20p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

An investigation of the applicability and refinement of

various procedures for the treatment and digestion of C-slags and other uraniferous residues for the recovery of U values is reported. (J.E.D.)

1822 NYO-7783

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATION TO DETERMINE THE FEASIBILITY OF ULTRASONIC LIQUID-LIQUID EXTRACTION. Progress Report No. 8 Covering Period from October 1 to November 30, 1956. Nov. 1956. 15p. Contract AT(30-1)-1798. $3.30(ph OTS); $2.40(mf OTS).

The two-stage mixer-settler system resulted in stage extraction efficiencies of approximately 99% under the influence of ultrasonic treatment as compared with 52% for the non-ultrasonic control. Individually, ultrasonic treatment resulted in extraction of 91% of the acid present in Stage 2 and 90.7% of the remainder in Stage 1 as opposed to 33.5 and 27.8% respectively for the control runs. Average approach to equilibrium for the ultrasonic tests was 98% compared with but 48% for the controls. Fabrication was completed on a newly designed standing-wave emulsion-breaking vessel which incorporates an adjustable reflector-to-radiator distance and angle to obtain the correct standing wave relationship. (auth)

1823 ORNL-2214

Oak Ridge National Lab., Tenn.

PROCESS TEST SECTION PROGRESS REPORT FOR AUGUST 1956. A. D. Ryon and K. O. Johnsson. Dec. 12, 1956. 13p. Contract W-7405-eng-26. $0.20(OTS).

A study of extraction rates and stripping with a Dapex-type liquor, and a high uranium, high vanadium liquor is reported. The equipment used was a 6-in. mixer cell with a 3-in. 4 flat-blade turbine impeller. The organic extractant used was di-(2-ethylhexyl) phosphoric acid and TBP in kerosene. (T.R.H.)

1824 ORNL-2215

Oak Ridge National Lab., Tenn.

PROCESS TEST SECTION PROGRESS REPORT FOR SEPTEMBER 1956. A. D. Ryon and K. O. Johnsson. Dec. 12, 1956. 12p. Contract W-7405-eng-26. $0.15 (OTS).

Progress in the solvent extraction of uranium is reported. (For preceding period see ORNL-2214.) (T.R.H.)

1825 TID-7528(Pt. 1)

Oak Ridge Operations Office. Feed Materials Div., AEC.

PROCESSING OF URANIUM–MAGNESIUM FLUORIDE SLAG—TECHNICAL INFORMATION MEETING, DECEMBER 6, 1956. Dec. 1956. 83p. $0.50(OTS).

1826 Y-B65-103

[Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.]

THE LARGE SCALE SEPARATION OF ZIRCONIUM AND HAFNIUM. J. M. Googin. Sept. 4, 1956. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Of all the processes devised for the separation of Zr and Hf, only two using counter current solvent extraction have been shown to be economical for large scale operations. The newer one involving the extraction of the nitrates from HNO_3 solution with TBP has only progressed through pilot plant operations. The older process involving the thiocyanates of the metals in HCl solution and hexone has been reduced to a routine operation. The processes are discussed with regard to the chemistry involved, the kinds and limitations of the equipment required, and the efficiency of operation to be expected. (auth)

1827

OPERATING CHARACTERISTICS OF A CENTRIFUGAL EXTRACTOR. F. M. Jacobsen and G. H. Beyer (Iowa State Coll., Ames). A.I.Ch.E. Journal 2, 283-9(1956) Sept.

The operating characteristics of a Podbielniak model 5,000 centrifugal extractor, having a combined-stream capacity of 450 cc./min. at 5,000 rev./min. and a rotor holdup of 529 cc., were investigated. Variables studied were density difference, rotor speed, light-liquid-out pressure, flow rates, holdup, and number of stages. A technique for holdup determination is described and experimentally demonstrated. An equation useful in predicting flooding limits is verified. A relationship among number of stages, light-liquid-out pressure, and flow-rate ratio is demonstrated by extracting boric acid from isoamyl alcohol with water. A procedure is outlined for applying the methods to other systems using similar extractors. First the constants in an equation are estimated from holdup measurements in order to predict flooding limits. Then a few extraction runs are made to estimate optimum operating conditions. (auth)

1828

MASS TRANSFER RATES IN ION EXCHANGE. W. A. Selke, Y. Bard, A. D. Pasternak, and S. K. Aditya (Columbia Univ., New York). A.I.Ch.E. Journal 2, 468-70(1956) Dec.

The rates of both the liquid-phase mass transfer and the internal-diffusion steps in ion exchange were studied by means of shallow-bed experiments. The mass transfer coefficients obtained fitted the general correlations for other packed-bed operations when the Schmidt group was evaluated with experimentally determined ionic counterdiffusivities. An incremental calculation of the diffusion rates within the particles yielded a value of the counterdiffusivity in the resin phase. A general design procedure based on these findings is proposed. (auth)

1829

ON THE TRANSPORT NUMBER FOR ION-EXCHANGE RESIN MEMBRANES. Yoshio Oda and Tadashi Yawataya (Research Lab., Asahi Glass Co., Ltd., Benten-cho Tsurumi-ku, Yokohama). Bull. Chem. Soc. Japan 29, 673-9(1956)Aug.

The cation transport numbers through cation-exchange resin membranes were determined experimentally by two methods, first, computation from membrane potential measurement, and second from analytical tracing of the concentration change which takes place, on current passage, in the solution separated by the membrane. The former, which is considered as "Hittorf transport number", is found to be far smaller than the latter, the true transport number. The difference between the two sorts of transport number was accounted for on the basis of the concept of convective conduction within the pores of ion-exchange resin. The electroosmotic water transference through the membrane was discussed on comparing the results of its volumetric- and gravimetric measurements. (auth)

1830

EXTRACTION OF CUPFERRONATES OF NIOBIUM, TANTALUM, AND TITANIUM. I. P. Alimarin and I. M. Gibalo (Lomonosov Moscow State Univ.). Doklady Akad. Nauk. S.S.S.R. 109, 1137-9(1956) Aug. 21. (In Russian)

A method is offered for segregation of Ti from materials containing Nb, Ta, and Ti. A satisfactory result was obtained of Ti segregation from the solution of Nb_2O_5 + Ta_2O_5, with various ratios of Ti, by extraction of cupferronates with the isoamyl alcohol pH5. The segregation was checked by H_2O_2 and by radioactive isotopes Nb^{95} and Ta^{182} with activity of 2000 to 3000 imp/min per 1 ml. (R.V.J.)

1831

ADSORPTION OF THORIUM BY ANION-EXCHANGE RESINS FROM NITRIC ACID MEDIA. J. Danon (Escola Nacional de Quimica, Rio de Janeiro, Brazil). J. Am. Chem. Soc. 78, 5953-4(1956) Nov. 20.

Trace amounts and weighable quantities of Th are completely adsorbed on Dowex-1 from 7 to 8M HNO_3 solutions. The Th may be eluted with dilute or concentrated HCL. (T.R.H.)

1832

CHEMISTRY OF BORIDES. G. V. Samsonov and L. Ya. Markovskiĭ. Uspekhi Khim. 25, 190-241(1956) Feb. (In Russian)

A review is given of the methods of preparation, crystal structure, and physical and chemical properties of elementary boron and of borides of various groups of elements. Phase studies, thermal expansion, electroconductivity, solubility, and other properties of alkaline earth metals of the first group on the periodic table: Cu, Ag, and Au, and Be, Mg, dissoluble Mg, and hexaborides of Ca, Sr, and Ba of the second group are described. Studies were made of borides of rare earth elements in the third group: the La, Ce, Nd, Yb, Y, Ge, and the Al borides. The fourth group (even parity subgroup)—the boron carbides were analyzed for their chemical resistance, their interactions with other carbides and high melting point alloys. Detailed descriptions of the physical and chemical properties at elevated temperatures of boron nitrides in the fifth group (uneven parity subgroup), the distribution of boron atoms in borides, and the table of structure classifications for transition metals are presented. Methods for preparation of transition metal borides, boride precipitation from gas phase, electrolysis, and preparations of solid specimens are discussed. Phase and x-radiation studies were made of the fifth group borides (uneven parity subgroup) of V, Nb, and Ta; of sixth group (uneven parity), Cr, Mo, and W borides; and, the eighth group—the iron borides. The properties of actinide borides and the general use and applications of borides are given. 233 references. (R.V.J.)

1833

COLORIMETRIC DETERMINATION OF NIOBIUM AND TANTALUM IN ORES. F. V. Zaikovskiĭ (All Union Mineral Research Inst.). Zhur. Analit. Khim. 11, 553-9(1956) Sept.-Oct. (In Russian)

A colorimetric method of Nb and Ta determination in rocks with pyrocatechin or pyrogallol after separation of Ni, Ta, and Ti by extraction has been developed. Pyrocatechin properties of Ni, Ta, and Ti complexes extracted by n-butanol at various pH values of oxalate solutions were utilized. The method was verified on various ore determinations. (tr-auth)

1834

CHROMATOGRAPHIC SEPARATION OF RADIOISOTOPES OF YTTRIUM GROUP ELEMENTS OBTAINED FROM YTTERBIUM AND HAFNIUM BOMBARDED BY HIGH ENERGY PROTONS. A. A. Pozdnyakov. (Vernadskiĭ Moscow Inst. of Geochemistry and Analytical Chemistry). Zhur. Analit. Khim. 11, 566-71(1956) Sept.-Oct. (In Russian)

Effects of the eluting solutions (ammonium oxalate, ammonium lactate) upon the separation efficiency of the elements of yttrium group have been studied. The best results were obtained with 0.4M ammonium lactate solution with pH 3.4; the use of solutions with pH value <3.4 leads to noneffective separation. The use of solutions with smaller pH values resulted in slow elution. The carrier quantity (more than 0.1 mg) reduces the efficiency of separation of the given element from the neighboring one causing poor separation. (tr-auth)

SYNTHESES

1835 NBS-4568

National Bureau of Standards, Washington, D. C.

THE PREPARATION OF D-ARABINOSE-5-C^{14} FROM D-GLUCOSE-6-C^{14}. Horace S. Isbell, Nancy B. Holt, and Harriet L. Frush. Mar. 15, 1956. 5p. $0.15(OTS).

The preparation of D-Arabinose-5-C^{14} from D-glucose-6-C^{14} by bromine oxidation to D-gluconic-6-C^{14} acid, followed by a Ruff degradation of the calcium salt is described. The over-all yield, 58%, was obtained without the separation of any intermediate products. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

1836

THE ELECTRONIC STRUCTURE AND MAGNETIC PROPERTIES OF URANYL-LIKE IONS. II. PLUTONYL. J. C. Eisenstein (Pennsylvania State Univ., University Park) and M. H. L. Pryce (Univ. of Bristol, England). Proc. Roy. Soc. (London) A238, 31-45(1956) Dec. 4.

The electronic configuration and bonding in $(PuO_2)^{2+}$ are considered. The calculated energy levels can be correlated satisfactorily with the absorption spectrum of $(PuO_2)^{2+}$ in aqueous solution by a plausible choice of numerical parameters. The microwave resonance absorption and paramagnetic susceptibility are derived on the basis of the model, and are in good agreement with experimental results. (auth)

URANIUM AND URANIUM COMPOUNDS

1837 LA-2043

Los Alamos Scientific Lab., N. Mex.

THE PROPERTIES OF PHOSPHORIC ACID SOLUTIONS OF URANIUM AS FUELS FOR HOMOGENEOUS REACTORS. B. J. Thamer, R. M. Bidwell, H. M. Busey, R. A. Clark, S. H. Cox, L. A. Geoffrion, R. P. Hammond, G. E. Meadows, B. J. Melton, R. H. Perkins, J. R. Phillips, M. G. Redman, J. D. Rogers, A. Sesonske, L. R. Sitney, E. O. Swickard, W. R. Wykoff, and J. B. Zorn. Mar. 6, 1956. 59p. Contract W-7405-Eng-36. $0.40(OTS).

Data secured up to March 1956 are given on the properties of $UO_3-H_3PO_4-H_2O$ solutions that might be suitable for use in homogeneous reactors. Included is information on solubility, radiation stability, vapor pressure, thermal expansion of the liquid phase, and corrosion. Sufficient U solubility in the system $UO_3-H_3PO_4-H_2O$ is readily obtainable with as little as 2 or 3M H_3PO_4. Adequate U solubility in the system $UO_2-H_3PO_4-H_2O$ requires the use of concentrated H_3PO_4, but these solutions have the advantages of low vapor pressure and low equilibrium pressure of radiolytic H_2 and O_2. A brief discussion is given of feasible methods of reprocessing phosphate fuel solutions with the use of only inorganic reagents. (auth)

1838 AEC-tr-2701

DEPOSIT OF URANIUM DIOXIDE ON ALUMINUM BY ELECTROLYSIS. Lydie Koch. Translated by Jane Gurney and Frances L. Ball from J. Nuclear Energy 2, 110-11(1955). 3p.

(An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-5028.)

1839

SPECTROPHOTOMETRIC AND POLAROGRAPHIC STUDIES OF THE URANYL COMPLEX OF DIHYDROXYMALEIC ACID. Jolanda M. Hojman. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 113-30(1956) Mar.

The influence of pH on the absorption spectra of UO_2^+ in the presence of dihydroxymaleic acid (DM) in various molar ratios was investigated. It was shown that at pH 3.0 the combining ratio of the complex is U/DM = 1/1, while at pH 6.8 another complex is also formed, having the combining ratio U/DM = 2/1. The investigation of the influence of pH on the half-wave potential of the complex also proved that the composition of the complex varies with pH. The reduction of the complex at the dropping mercury electrode is reversible or irreversible, depending on pH. The polaro-

graphic determination of U as dihydroxymaleate complex was studied and it was found that I_d/C is constant in neutral and weakly alkaline media. The half-wave potentials of the complexes of dihydroxymaleic acid with other cations were determined. (auth)

1840

ISOLATION OF URANIUM–ASCORBIC ACID COMPLEX. Ivan J. Gal. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 173-4(1956) Mar.

The isolation of an anionic complex of UO_2^{2+} with l-ascorbic acid is described and some of its properties are given. (T.R.H.)

Refer also to abstract 1759.

WASTE DISPOSAL

1841 NYO-4440

Massachusetts Inst. of Tech., Cambridge. Sedgwick Labs. of Sanitary Science.

A STUDY OF THE REMOVAL OF RADIOACTIVE PARTICULATE MATTER FOR WATER BY COAGULATION. Nathan C. Burbank, Jr., Robert A. Lauderdale, and Rolf Eliassen. Sept. 1, 1955. 116p. Contract AT(30-1)-621. $0.60(OTS).

The character of radioactive particulate matter in rainout was determined as to size distribution and elemental composition. The particulate removal efficiency of alum, chlorinated Cuas, and lime-soda ash softening was determined for waters typical of the Midwest and Southwest areas of the United States and of alum and chlorinated Cuas for water typical of New England and the Far Northwest. The mechanism by which particulate matter was removed by coagulation utilized the principles of physical and crystal chemistry and x-ray diffraction. These methods showed: Radioactive particulate matter, when suspended in water, demonstrates a preferential adsorption of anions upon its surface. The electrical activity of the particle is determined by the ions adsorbed. The removal by coagulation with either alum or chlorinated Cuas occurs through the action of the particles serving as nuclei for the formation of hydrous oxide floc. The presence of an adsorbed layer of SO_4^{2-} on the radioactive particles increases the production of nuclei and improves removal efficiency. These anions are acquired by the microcrystalline floc in the process. The removal by softening with lime-soda ash is accomplished by the precipitation of calcite and/or brucite in chains and aggregates about a particle. The attachment is similar to that of the hydrous oxide flocs and the crystal is attached at the corner or edge of a face, the active surface of crystal growth. (auth)

1842

OPEN FIELD BURNING OF LOW LEVEL RADIOACTIVE CONTAMINATED COMBUSTIBLE WASTES. W. B. Harris and M. S. Weinstein (Industrial Hygiene Branch, AEC, New York). Am. Ind. Hyg. Assoc. Quart. 17, 388-90(1956) Dec.

Three investigations at three different levels of volume up to approximately 10 tons have been conducted. These involved burning of contaminated laboratory wastes containing millicurie amounts of activity in an uncontrolled open field. Extensive sampling of the area out to a distance of 2,000 feet revealed negligible contamination of the air and negligible fallout under the conditions of test. (auth)

1843

THE MANAGEMENT OF POWER REACTOR WASTES. G. Hoyt Whipple (Univ. of Rochester, N. Y.). Am. Ind. Hyg. Assoc. Quart. 17, 420-5(1956) Dec.

A power reactor industry presents some unusual problems in waste disposal. Reactor wastes have the unique properties of enormous amounts of radioactivity, extreme and long-lived toxicity which cannot be rendered benign by treatment, and consequent difficulty of recovering from errors and accidents. These properties, and the ability of some living organisms to concentrate materials from their environment, preclude the release of significant quantities of the wastes. A possible exception is 9.4-year krypton^{85}, which cannot be concentrated biologically. Most reactor wastes are now stored in underground tanks, which is not a permanent solution. Fixation in concrete, clay, and glass is under study, but the rates of release must be very slow. Utilization of the wastes as sources of radiation, heat, and rare elements affects the problem only insofar as it helps pay the disposal costs. Reactor waste management will probably take the form of separation and storage of the inert gases until controlled release to atmosphere is possible, concentration of the other wastes in solid or liquid form and storage for 10 to 20 years, separation and storage of the strontium and cesium, and fixation of the remainder and burial in the ocean or in dry ground. (auth)

1844

DISPOSAL OF RADIOACTIVE WASTE. Bernard Manowitz (Brookhaven National Lab., Upton, N. Y.). Consulting Engineer 6, No. 6, 36-41(1955) Dec.

The atomic energy program is reviewed from the standpoint of radioactive waste disposal. Data are tabulated on the characteristics of significant fission products and the costs of various disposal processes. (C.H.)

ENGINEERING

1845

MULTILAYER VESSELS FOR HIGH PRESSURE AND TEMPERATURE. T. McLean Jasper (A. O. Smith Corp., Milwaukee, Wisconsin). Chem. Eng. Progr. 52, 521-27 (1956) Dec.

Problems in designing, fabricating, testing, and inspecting pressure vessels are reviewed. The simplification of such problems by the use of multilayer vessels is discussed. (T.R.H.)

HEAT TRANSFER AND FLUID FLOW

1846 CF-56-11-136

Oak Ridge National Lab., Tenn.

RUN SUMMARY OF RUN HRT-CP-3 AND 4. R. H. Winget. Nov. 28, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

In an experiment to determine if solids charged into a loop would remain in the circulating stream, a steady drop was found in solids concentration occurring throughout the run until a minimum value of 0.03 mg/ml was reached. The solids factor dropped by a factor of about 2 every 8 hrs. (F.S.)

1847 CF-56-11-137

Oak Ridge National Lab., Tenn.

RUN SUMMARY OF HRT-CP-5. R. H. Winget. Nov. 29, 1956. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An experiment to determine the effectiveness of a 400-mill hydroclone for removing solids of low concentrations in the HRT chemical plant showed that the concentration of solids varied with the time of hydroclone operation and solids addition. (F.S.)

1848 NDA-26

Nuclear Development Corp. of America, White Plains, N. Y.

REACTOR HEAT TRANSFER PROGRESS. [Issue] No. 9. Unclassified Section. (15J-13). John E. Viscardi, ed. Apr. 27, 1956. 40p. Contract AT(30-1)-862. $7.80(ph OTS); $3.30(mf OTS).

There is no classified Section of Issue No. 9.

Transient pool boiling due to sudden large heat generation was investigated to study the effect of sudden large power surges on surface boiling and metallic ribbon fuel element burnout. Heat transfer to water from platinum surfaces was studied in fending the time required for initiation of boiling when the surface temperature exceeded boiling. In an investigation of the effect of vertically downward flow on burnout flux, no difference was found in the burnout flux due to the direction of flow. Molten metal-water reaction tests were continued. The temperature distribution in boiling water was determined with liquid heads up to 1 meter and the effect of convection on the temperature distribution was studied. (F.S.)

1849 NDA-30

Nuclear Development Corp. of America, White Plains, N. Y.

REACTOR HEAT TRANSFER PROGRESS. [Issue] No. 12. Unclassified Section. (15J-16). John E. Viscardi, ed. Oct. 30, 1956. 19p. Contract AT(30-1)-862. $4.80 (ph OTS); $2.70(mf OTS).

Abstracts are given for 26 papers on the latest results in high-performance heat transfer research and development for all types of nuclear reactor systems. (F.S.)

1850 NP-6156

Mine Safety Applicances Co., Callery, Penna.

TWO TUBE STEAM EVAPORATOR NO. 3. Technical Report No. 51. W. Milich, E. A. Schultz, and E. C. King. Nov. 26, 1956. 45p. Contract NObs-65426.

A two-tube steam evaporator made of 2¼% Cr–1% Mo steel and having a gas-filled third fluid leak monitoring system (duplex tube), was tested and its performance compared with similar units constructed of types 304 and 347 stainless steel. Steam at 500 psig was generated, using a NaK inlet temperature of 850 F. The highest value of 765 Btu/hr-sq ft-°F for the over-all heat transfer coefficient, U, was obtained with a helium third fluid pressure of 200 psig. Lower coefficients were obtained at 20 and 600 psig. Using nitrogen, the optimum U occurred with a third fluid pressure range between 20 and 200 psig. At the start of the program the U was found to be 660 Btu/hr-sq ft-°F at a NaK flow of 2450 lbs/hr-tube as compared to 610 Btu/hr-sq ft-°F at the completion of the program. This represents a 7½% drop in performance, with 75% of the drop occurring during the first 25% of the cyclic program. The over-all drop in U for the type 347 stainless steel evaporator was 2%, and for the type 304 stainless steel evaporator was 37% before it failed. The tubes in the present evaporator are to be reexpanded and the unit operated for an additional length of time to see if the original operating efficiency may be recovered. (auth)

1851

TWO-PHASE FLOW OF HYDROGEN IN HORIZONTAL TUBES. John D. Rogers (Los Alamos Scientific Lab., New Mexico). A.I.Ch.E. Journal 2, 536-8(1956) Dec.

Semirigorous equations are developed for flow of flashing liquids in pipe lines. (auth)

1852

EFFECT OF FLUID MOTION ON INTERFACIAL AREA OF DISPERSIONS. W. A. Rodger and V. G. Trice, Jr. (Chemical Engineering Div., Argonne National Lab., Chicago) and J. H. Rushton (Department of Chemical Engineering, Purdue Univ., Lafayette, Ind.). Chem. Eng. Progr. 52, 515-20(1956) Dec.

Prediction, by the designer of liquid-liquid contacting systems, of interfacial areas of dispersions so that mass transfer coefficients can be related directly to fluid motion, is now materially aided by the experimental results reported. Interfacial area of drops formed by sheer stresses in turbulent fluid motion is now related to a combination of equipment size, turbulence, and interfacial tension force factors. In practical terms, it should be possible now to gather data for various mass transfer operations as a function of fluid mechanics, and to relate the coefficients determined in small-scale experimental units to the coefficients which would be the basis for design of large-scale industrial operations. (auth)

1853

ASYMPTOTIC EXPANSIONS OF SOLUTIONS OF THE HEAT CONDUCTION EQUATION IN INTERNALLY BOUNDED CYLINDRICAL GEOMETRY. R. H. Ritchie (Oak Ridge National Lab., Tenn.) and A. Y. Sakakura (U. S. Geological Survey, Denver, Colo.). J. Appl. Phys. 27, 1453-9(1956) Dec.

The formal solutions of problems involving transient heat conduction in infinite internally bounded cylindrical solids may be obtained by the Laplace transform method. Asymptotic series representing the solutions for large values of time are given in terms of functions related to the derivatives of the reciprocal gamma function. The results are applied to the case of the internally bounded infinite cylindrical medium with, (a) the boundary held at constant temperature; (b) with constant heat flow over the boundary; and (c) with the "radiation" boundary condition. A problem in the flow of gas through a porous medium is considered in detail. (auth)

1854

THE EFFECT OF THERMAL GRADIENTS ON METALLIC SLURRIES. G. W. Greenwood and B. Sharpe (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 3, 1-6(1956) Aug.

The effect of horizontal thermal gradients of about 200° C/cm on slurries in cans has been investigated experimentally. For slurries of UPb_2 in liquid lead and UBi_2 in liquid bismuth, complete transfer of particles to the cold end of the can was observed and some particle growth noted. On reversal of the thermal gradient, particles were retransported to the cold end of the can. A slurry of copper particles in liquid lead behaved similarly, indicating that the effect did not depend on relative particle and liquid densities. Neither particle transfer nor growth was found to occur in a slurry of uranium particles in liquid sodium. The results are interpreted in terms of convection flow and the variation of particle solubility in the liquid at different temperatures. Particles in the nearly static liquid adjacent to the coldest can-wall may trap other particles to form a region of high viscosity, whilst particles carried in the convecting liquid through the hot regions are tending to dissolve and the solute is redeposited on particles in the cold regions. Some comments on probable slurry reactor fuel behaviour are put forward in the light of the present work. (auth)

1855

THERMAL CONDUCTIVITIES OF LIQUIDS: NEW DETERMINATIONS FOR SEVEN LIQUIDS AND APPRAISAL OF EXISTING VALUES. A. R. Challoner and R. W. Powell. Proc. Roy. Soc. (London) A238, 90-106(1956) Dec. 4.

A guarded hot-plate apparatus is described and used for absolute determinations of the thermal conductivities of liquids over the range 2 to 82°C. The liquids studied are water, heavy water (99.95% D_2O), glycerine, ethyl alcohol, toluene, medicinal paraffin and carbon tetrachloride. For

each liquid graphical representation of the variation of thermal conductivity with temperature enables existing values to be compared with those of the present investigation. (auth)

MATERIALS TESTING

1856 WT-1184
Santa Fe Operations [Office], AEC.
NUCLEAR EFFECTS ON MACHINE TOOLS. L. N. Sparks. Mar. 1956. 66p. Project 34.4 [of] OPERATION TEAPOT. $0.40(OTS).

Eleven heavy-duty machine tools of various types and sizes were exposed to an open atomic explosion. Flying debris, not blast, created the major damage to the machines. Vulnerability of the machines to damage appeared to exist in the failure of fragile external parts. (C.H.)

RADIOGRAPHY

Refer to abstract 1892.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1857 MCC-1023-TR-214
Ohio State Univ. Research Foundation, Columbus.
THE VAPORIZATION OF BORON NITRIDE AND ALUMINUM NITRIDE. M. Hock and D. White. Oct. 29, 1956. 8p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The vaporization of BN and AlN was studied by the Knudsen effusion method in the temperature range 1660 to 2196°K. The ratio of the surface of the effusion hole to that of the evaporating material, h/S, was varied from 0.572 to 1.23×10^{-4}. Although BN has a crystal structure similar to graphite and AlN has a wurtzite structure, and although BN decomposes into solid B and gaseous N_2, while AlN decomposes into gaseous Al and gaseous N_2, the accommodation coefficient, α, was in both cases very small and of the same magnitude, 1×10^{-4}. The small accommodation coefficient cannot be ascribed simply to the structure of the solid or to the decomposition reaction. Furthermore, since the accommodation coefficients of TiN and ZrN were found to be close to unity, the high dissociation energy of N_2 cannot be responsible for the small accommodation coefficient of BN and AlN. (auth)

1858
SOME PHYSICAL PROPERTIES OF HIGH-DENSITY THORIUM DIOXIDE. S. M. Lang and F. P. Knudsen (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc. 39, 415-24(1956) Dec.

The values for a number of physical properties are reported for a very high density form of thorium dioxide. When specimens of a mixture of 99½% ThO_2 and ½% CaO, by weight, were hydrostatically pressed at 30,000 lb. per sq. in. and heat-treated for 1 hour at 1800°C., they attained 99.0% of theoretical density. All the test specimens were extremely brittle. Physical property values determined at room temperature were the following: lattice constant; bulk and theoretical (x-ray) densities; compressive and impact strengths; Knoop hardness; modulus of rupture and Young's modulus, determined by a static method; Young's modulus and the shear modulus, determined by a dynamic method; Poisson's ratio and the bulk modulus, calculated from the dynamic-test data; and the velocity of sound through the material. The properties determined at elevated temperatures were the following: linear thermal expansion; modulus of rupture and Young's modulus, determined by a static method; Young's modulus and the shear modulus, determined by a dynamic method; and Poisson's ratio, calculated from the elevated-temperature dynamic-test data. "Martin's diameter" grain counts were taken for the material both before and after heat-treatment. (auth)

1859
THERMAL EXPANSION OF VARIOUS CERAMIC MATERIALS TO 1500° C. Osgood J. Whittemore, Jr. and Neil N. Ault (Research and Development Department, Norton Company, Worcester, Mass.). J. Am. Ceram. Soc. 39, 443-4 (1956) Dec.

Thermal expansion data from room temperature to 1500°C are given for a number of ceramic materials. Determinations were made with telemicroscopes on bars or rods 7 in. long. (auth)

1860
HIGH TEMPERATURE EFFECTS ON INSOLATION PROPERTIES OF CERAMICS. I. E. Balygin and K. S. Porovskii. Zhur. Tekh. Fiz. 26, 1714-22(1956) Aug. (In Russian)

Deep structural alterations caused by ion transitions in the oxide components in ceramic materials tested at 380°C under constant tension were studied. Spinels and steatites showed the best working stability at elevated temperatures. (R.V.J.)

1861
HIGH-TEMPERATURE TECHNOLOGY. I. E. Campbell, ed. New York, John Wiley and Sons, Inc., 1956. 526p. London, Chapman and Hall, Ltd., 1956.

The technology of high-temperature refractory materials has been studied. The refractory properties of metals, oxides, carbides, borides, silicides, nitrides, sulfides, cermets, and special properties of carbon and graphite at high temperatures are discussed. The topics include the sintering methods for metallic and non-metallic refractory materials; resistance and induction-heated furnaces; arc furnaces; solar furnaces; and, other methods of achieving high temperatures. The measurement methods, the mechanical and physical properties at high temperatures and high temperature microscopy and x-ray diffraction are, also, described. (R.V.J.)

CORROSION

1862 CF-56-7-51
Oak Ridge National Lab., Tenn.
HRP DYNAMIC SLURRY CORROSION STUDIES: QUARTER ENDING JULY 31, 1956. E. L. Compere, H. C. Savage, S. A. Reed, G. E. Moore, R. M. Warner, R. M. Pierce, D. B. Weaver, J. A. Russell, Jr., and S. R. Buxton. July 31, 1956. 49p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Dynamic corrosion data are presented for two slurry runs made in 100A pump loop CS. Calibration water runs and an attempted slurry run on the experimental in-pile slurry loop are described. Studies in toroids of circulating ThO_2 slurries indicate some correlation between ultimate particle size and attack rate on stainless steel. The preparation and behavior of sized fraction of ThO_2 calcined at 1200, 1400, and 1600°C are given. (For preceding period see CF-56-4-139.) (W.L.H.)

1863 CF-56-11-118
Oak Ridge National Lab., Tenn.
SUMMARY OF CORROSION SAMPLE DATA FOR HRT MOCKUP OPERATIONAL PERIOD ENDING JULY 28, 1956. R. E. Wacker and E. L. Compere. Nov. 27, 1956. 32p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00 (mf OTS).

1864 CRDC-645
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
SOME LOOP EXPERIMENTS IN NRX REACTOR TO STUDY THE CORROSION OF MILD STEEL BY FLOWING WATER AT 90°F. G. M. Allison. Nov. 1956. 24p. (AECL-360).

The water conditions necessary for minimum corrosion in the mild steel thermal shield recirculating systems in NRX and NRU were studied. The chemical and corrosion results obtained by operating three mild steel loops in which water at 85 to 95°F was recirculated through test sections located in J-rod positions in the NRX reactor are reported. Lowest corrosion rates were found when the water was maintained at pH 10.5 with or without oxygen being present. In both cases the corrosion was general in nature and no pitting occurred. At pH 7 with oxygen present in the water severe pitting took place and the corrosion rate was several times higher than similar conditions without oxygen in the water. Under oxygen-free conditions the corrosion product was Fe_3O_4. At pH 7 and with 3 to 5 ppm of O_2 in the water the corrosion product was a mixture of Fe_3O_4 and γ-Fe_2O_3. At high pH with oxygen present Fe_3O_4 predominated with some traces of Fe_2O_3. The systems tested may be listed in order of increasing corrosiveness: high pH with or without O_2 in the water < water at pH 7 with no O_2 present and continual purification < water with no O_2 present and no purification or pH control < water at pH 7 with 3 to 5 ppm of O_2 present. (auth)

1865 EES-040028M
Naval Engineering Experiment Station, Annapolis.
STRESS CORROSION TESTS OF STAINLESS STEELS IN HIGH TEMPERATURE WATERS. R. B. Niederberger. Feb. 15, 1956. 17p.

Laboratory stress corrosion tests, using U-bend specimens exposed in the liquid and vapor phases of chloride bearing boiler water at 500°F, have been conducted with type 304 stainless steel, stress relieved at 900°F and at 1700°F after preparation of specimens, type 430 stainless steel, carpenter 7 Mo steel, and with a group of 6 austenitic steels containing nickel in amounts ranging from 10 to 40%. Stress corrosion cracking occurred in vapor exposed specimens of all materials except Type 430 stainless steel. The results confirm the conclusion that austenitic stainless steels as a class are subject to stress corrosion cracking in high temperature waters containing chloride and O. (auth)

1866 HARD(C)/P-20
Atomic Energy Research Establishment, Harwell, Berks, England.
THE DESCALING OF STAINLESS STEEL SPECIMENS CORRODED IN HOMOGENEOUS AQUEOUS REACTOR "SOUP." R. Littlewood. Oct. 12, 1956. 5p.

1867 HW-42364
Hanford Atomic Products Operation, Richland, Wash.
CORROSION OF ALUMINUM IN URANIUM NITRATE SOLUTIONS. V. H. Troutner. Apr. 6, 1956. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The corrosion of Al in uranium nitrate solution has been shown in laboratory tests to be too severe to permit the use of Al for containing hot uranium nitrate solutions. A minimum corrosion penetration rate of 2 mils per day was observed with M-329 Al in 1% uranium nitrate hexahydrate in pH 2 aqueous solution at 100°C. (auth)

1868 KAPL-M-DCB-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE CORROSION BEHAVIOR OF SOME ZIRCONIUM 8 w% URANIUM ALLOYS IN 680 F WATER. Donald C. Belouin. Dec. 5, 1956. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The corrosion behavior of U-Zr alloys in high-temperature water is significantly affected by frequent inspection during long test periods. The effect of heat treatment on these alloys is essentially the same as observed in previous experimental work; namely a quench from 1000°C offers a more favorable structure from a corrosion viewpoint than a 575°C anneal. It appears that the minor alloying elements used in preparation of these alloys have a very important part in their resistance to corrosion. Unfortunately, the data are not sufficiently broad to allow conclusive evaluation of the effect of these alloying elements independent of heat treatment. (auth)

1869 TML-57
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
THE CORROSION OF TITANIUM. D. W. Stough, F. W. Fink, and R. S. Peoples. Oct. 29, 1956. 184p. Contract AF18(600)-1375.

The corrosion properties of Ti and some Ti alloys are reported. The data were obtained from the results of laboratory investigations and from reports of the behavior of Ti in service. Included are corrosion rates in various environments, a description of industrial and military corrosion experiences with Ti, and the results of fundamental studies of the corrosion and passivating processes on Ti. (auth)

1870 WAPD-T-254
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
AQUEOUS CORROSION OF ZIRCONIUM AND ITS ALLOYS AT ELEVATED TEMPERATURES. D. E. Thomas. 17p. Contract [AT-11-1-GEN-14]. $3.30(ph OTS); $2.40(mf OTS).

The corrosion behavior of Zr and Zr alloys is discussed. Corrosion test specimens are bright etched in a solution of H_2O, HNO_3, and HF in the ratio 10:9:1 and rinsed prior to exposure. Specimens are suspended in stainless steel pressure vessels containing degassed high-purity H_2O at temperatures below the critical point (705°F) at equilibrium pressure. (J.H.M.)

GEOLOGY AND MINERALOGY

1871
STUDIES OF URANIUM MINERALS. XXII. SYNTHETIC CALCIUM AND LEAD URANYL PHOSPHATE MINERALS. Virginia Ross (Harvard Univ., Cambridge, Mass.). Am. Mineralogist 41, 915-26(1956) Nov.-Dec.

The uranium minerals phosphuranylite, renardite, "dewindtite," dumontite, parsonsite and the phase lead-autunite have been investigated synthetically to establish identity and the conditions of deposition. In the acid range, autunite and parsonsite predominate. Under neutral and alkaline conditions, there exist a number of renardite-type phases of variable lead content with closely related x-ray spectra and properties. It is suggested that "dewindtite" be discredited as a distinct mineral species. A phase has been prepared that corresponds chemically but is not identical to dumontite on the basis of limited, existing data on the mineral. The methods of synthesis and resultant phases in the sys-

tems calcium- and lead-uranyl-phosphate-water are described. Chemical, optical, and x-ray data are included. (auth)

1872

A NEW METHOD FOR RADIOCHEMICAL PROSPECTING OF URANIUM ORE. I. ESTIMATION OF THE AMOUNT OF URANIUM. Yuji Yokoyama (Faculty of Liberal Arts and Education, Yokohama National Univ., Kamakura, Japan). Bull. Chem. Soc. Japan 29, 727-30(1956) Aug.

A radiochemical method for the prospecting and the estimation of the amount of uranium layer under the ground based upon the determination of radium in mineral waters, is described. Results show, 700 to 7,000 ton of uranium may occur in Hot Spring Tamagawa and 200 to 2,000 ton of uranium in Hot Spring Arima. The natural radioactive elements in mineral waters will give valuable information on the geological structures, especially the nature of the underground radioactive strata. (auth)

METALS AND METALLURGY

1873 AECU-3382

Case Inst. of Tech., Cleveland.

AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 14 [for] September 2, 1956 to December 2, 1956. E. B. Evans and W. M. Baldwin, Jr. Dec. 4, 1956. 7p. Contract AT(11-1)-258. $1.80(ph OTS); $1.80(mf OTS).

1874 CF-56-11-115

Oak Ridge National Lab., Tenn.

DEVELOPMENT OF A FABRICATION PROCEDURE FOR ZIRCALOY-2. M. L. Picklesimer and G. M. Adamson. Nov. 21, 1956. 19p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

A new fabrication procedure has been developed which eliminates the stringers usually found and which decreases the amount of preferred orientation present in the fabricated plate. The procedure consists essentially of fabricating either above 1780°F (970°C) or below 1490°F (810°C) with a finishing process consisting of heating to 1832°F (1000°C) or higher for approximately 30 minutes at temperature, water quenching if possible, air cooling rapidly if water quenching is not possible, cold or "warm" rolling (less than 500°C) with not less than 20% reduction, and annealing at 800°C or less for 15 to 30 minutes at temperature. The resulting material has no stringers, a grain size of ASTM 7 to 8, and much less preferred orientation resulting in more isotropic mechanical properties. This new procedure was determined by rolling plate material. The process should apply equally well to swaged or rolled rod material. (auth)

1875 COO-312

Brush Beryllium Co., Cleveland.

MECHANICAL PROPERTIES OF REACTOR-GRADE BERYLLIUM AT ELEVATED TEMPERATURES. R. G. O'Rourke, J. N. Hurd, K. G. Wikle, and W. W. Beaver. Aug. 1956. 142p. For Oak Ridge National Lab. Contract AT(30-1)-541. $0.70(OTS).

Results of a two-year program on the mechanical properties of vacuum hot-pressed reactor-grade Be are summarized. This study covered the temperature range of 800 to 1500°F and strain rates of 0.001 to 0.1 in./in./min. Addition of BeO to a level of 3% increases the mechanical strength of Be and improves stress-rupture and creep properties. At a total of 3% BeO, the equicohesive temperature of Be is increased about 200°F over that expected for reactor-grade, 1% BeO, Be. Elevated-temperature strengths and ductility of Be, determined by short-time tensile tests, were improved by a thermal treatment, which consisted in heating specimens in vacuum above the recrystallization temperature, followed by slow cooling. The strain-rate sensitivity of Be is apparent at 1000°F and increases with increasing temperature. Notch sensitivity decreases with increasing temperature up to 1000 or 1200°F, depending on oxide content. Tensile, compression, and rigidity moduli decrease slowly with increasing temperature up to 800 to 1000°F, but decrease more rapidly at higher temperatures. BeO content and strain rate do not affect moduli below 1000°F, but above this temperature an increase in oxide content or an increase in strain rate increases moduli. Creep and rupture studies have resulted in the formulation of creep laws for the reactor-grade Be and determination of the stress that would produce a 1% elongation in 2500 hrs at temperatures of interest. Indications are that a temperature-dependent hardening of Be occurs in the recrystallization-temperature region, 1200°F. (auth)

1876 HW-43049(Rev.)

Hanford Atomic Products Operation, Richland, Wash.

INERT-TUNGSTEN-ARC BUTT WELDING OF ZIRCALOY-2 TUBES. J. W. Lingafelter. Aug. 1, 1956. 23p. Contract W-31-109-Eng-52. $0.25(OTS).

From the information presented, it can be concluded that internally ribbed Zircaloy tubes can be successfully inert tungsten-arc butt-welded together to form long lengths of tubing. The welding procedure described is readily adaptable to an automatic operation using standard commercially available inert arc welding equipment. X-ray quality welds with good mechanical, metallurgical and corrosion properties can be made using the inert tungsten-arc welding procedure described. Butt-welded tubes can be expected to have good corrosion performance at 350°C and adequate room temperature mechanical properties for use with internal tube pressures of 2200 psi or less. (auth)

1877 ISC-761

Ames Lab., Ames, Iowa.

HANFORD SLUG SEMI-ANNUAL REPORT [FOR] JANUARY 1 TO JUNE 30, 1956. P. Chiotti, comp. Oct. 2, 1956. 13p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

The following subjects are discussed; allotropic transformations in U, heat treatment of U, phase studies of Zn-Zr alloys, thermal properties of Th, and engineering properties of materials. (For preceding period see ISC-709.) (W.L.H.)

1878 ISC-795

Ames Lab., Ames, Iowa.

TABULATION, BIBLIOGRAPHY, AND STRUCTURE OF BINARY INTERMETALLIC COMPOUNDS. I. COMPOUNDS OF LITHIUM, SODIUM, POTASSIUM, AND RUBIDIUM. S. G. Epstein, D. M. Bailey, R. L. Smythe, G. R. Kilp, and J. F. Smith. Sept. 1, 1956. 31p. Contract W-7405-eng-82. $0.25(OTS).

1879 KAPL-M-DBK-1

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF WELD TRANSITION JOINTS OF TYPE 304 STAINLESS STEEL TO CROLOY 2 1/4. D. B. Kittle. Nov. 20, 1956. 8p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

Results of the evaluation of the quality of welded transient joints between type 304 stainless steel and Croloy after thermal shock treatments are presented. (J.E.D.)

1880 KAPL-M-RCD-37

Knolls Atomic Power Lab., Schenectady, N. Y.

PRESSURE TEST OF THERMOCOUPLE INSERT SEAL WELD KOVAR TO STAINLESS. R. D. Gibbs. Oct. 15,

1956. 31p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

As a portion of the SAR Core Instrumentation, it was necessary to determine the stability of the seal weld for the ceramic and kovar connection assemblies, to the thermocouple receptacle. The primary purpose of this weld, other than structural design, is to maintain the seal of the upper cell housing with an adequate factor of safety under operating conditions of pressure and temperature. In order to test the weld under these conditions, a special plug simulating the thermocouple receptacle was made, and various connection assemblies welded in. The report deals with the testing and results of this assembly under conditions of 550°F and variable pressures to rupture by this means, to determine the safe operating range of the design. (auth)

1881 KAPL-M-SAT-2

Knolls Atomic Power Lab., Schenectady, N. Y.

INERT TUNGSTEN-ARC WELDING OF S3G ZIRCALOY CHANNEL SECTIONS. S. A. Toftegaard. Nov. 14, 1956. 6p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

A joint design using an inverted vee groove, .020-in. deep and ¼-in. wide at the underside of the joint gave the desired weld contour when welded with a current of 180 amp DCSP and a travel speed of 4 ipm. Bend test samples taken from welds made in this joint design were more ductile than samples from welds of the other joint designs that were tried. The tensile strength of the weld was greater than that of the base metal (82,600 psi for hot rolled material). (auth)

1882 PWAC-158

Vitro Labs., West Orange, N. J.

DEVELOPMENT OF SOLID-PHASE BONDING OF NICKEL BASE ALLOYS. Final Report [for] January 1–July 31, 1956. Dept. of Chemical Research and Development. Vitro Job 2054. A. C. Werner, H. G. Scheible, and H. Vartanian. 24p. For Pratt and Whitney Aircraft Div. Contract AT(11-1)-229. (KLX-10042). $4.80(ph OTS); $2.70(mf OTS).

Bound under a Pratt and Whitney cover with the title "VITRO LABORATORIES TECHNICAL FINAL REPORT ON THE DEVELOPMENT OF SOLID-PHASE BONDING OF NICKEL BASE ALLOYS," with a preface by D. K. Davis. Oct. 15, 1956. 1p.

An induction-heated furnace was constructed for hot pressing specimens in a reducing H_2 atmosphere. A study was made of the effect of several process variables on the ultimate shear strength of bonded double lap joints. Variables studied were sintering temperature, sintering pressure, sintering time, annealing time, bond thickness, reduction time, particle size of nickel oxide, surface treatment, and the number of bond surfaces coated. Of these, the most important were determined to be sintering temperature, pressure, and time. Bonded joints which ranged in strength from 3,000 to 40,000 psi were obtained by control of these three variables. Sintering temperature was found to be more important than sintering pressure in the formation of strong bonds. A sintering pressure of at least 1.25 tsi, was necessary for the formation of bonds having strengths between 10,000 to 30,000 psi. Annealing time, bond thickness, reduction time, particle size of nickel oxide, surface treatment, and the number of bond surfaces coated were less important for forming strong bonds. (auth)

1883 TML-39(Suppl.)

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

PHYSICAL-PROPERTY DATA FOR TITANIUM AND TITANIUM ALLOYS. Nov. 16, 1956. 11p. Contract [AF 18(600)-1375].

A literature survey of the physical properties of Ti and Ti alloys is presented. (J.E.D.)

1884 WAL-401/203-7

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF TITANIUM-BASE ALLOYS OF HIGH STRENGTH AND TOUGHNESS. Final Report [for] September 1, 1953 to August 31, 1955. C. R. Lillie and David W. Levinson. Oct. 3, 1956. 87p. ARF Project No. B 059. Contract DA-11-022-ORD-1428.

1885 WAL-401/204-5

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SOLID SOLUTION HARDENING OF ALPHA AND BETA TITANIUM. Final Technical Report [for] August 19, 1953 to August 19, 1955. J. J. Rausch and D[avid] W. Levinson. 96p. ARF Project No. B 060. Contract DA-11-022-ORD-1439.

The purposes of this program were to determine quantitatively the separate effects of Al, Sn, Zr, Si, Fe, V, Mo, Cr, Mn, O, N, and C as solid solutes in alpha Ti and of Cr, Fe, V, Mn, and Mo as solid solutes in beta Ti; furthermore, to study the effects of combinations of two and three of the above elements on solid solutions of alpha Ti. (auth)

1886 WAL-401/230-1

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

HEAT TREATMENT OF LARGE SECTIONS OF TITANIUM ALLOYS. Final Technical Report [for] June 30, 1954 to June 30, 1955. Rodney P. Elliott. Dec. 15, 1955. 89p. ARF Project No. B 071 and DA Project No. 593-08-021. Contract DAI-022-ORD-(P)-5.

The principles of heat treatment of large sections of Ti-base alloys are discussed. Specifically, means were studied to adopt the hardenability procedure of specification commonly used for steels to Ti alloys. Cooling curves for various positions in joining bars of Ti alloys were established. It is indicative that thermal diffusivities of Ti-base alloys vary to a sufficient degree that this variation will have to be taken into consideration in developing hardenability-type conversion charts. Two techniques have been devised whereby it is possible to determine both the thermal diffusivity and quenching efficiency by comparison of experimentally determined cooling curves. Using one of these techniques, the quenching efficiencies of brine, water and oil have been determined for pure Ti. (See also WAL-401/230). (auth)

1887 AEC-tr-2697

STUDY OF THE ALUMINA LAYERS DEPOSITED ON ALUMINUM BY ANODIC OXIDATION. J. J. Trillat and R. Tertian. Translated by K. S. Bevis from Rev. aluminium 26, 315-19(1949). 7p.

The results of some electron diffraction and x-ray diffraction experiments on samples of oxidized Al are reported. (T.R.H.)

1888

A NEW MODIFICATION OF TITANIUM MONOXIDE. Ulf Kuylenstierna and Arne Magneli (Univ. of Stockholm, Sweden). Acta Chem. Scand. 10, No. 7, 1195-6(1956).

Titanium monoxide was found to have a structure of $CaCl_2$ type with randomly distributed vacancies in both the Ti and O frame works and a broad range of homogeneity. Samples of this phase were prepared by melting mixtures of Ti metal and TiO_2 under an atmosphere in an electric furnace. Data are presented for a few of the compositions studied. (auth)

1889

THE ROLE OF METALLURGY IN A NUCLEAR ENERGY PROJECT. L. Rotherham (U. K. Atomic Energy Authority, Risley, Lancs, England). Brit. J. Appl. Phys., Suppl. No. 5, 91-5(1956).

The development of nuclear energy both for weapons and more particularly for peaceful applications is essentially a new branch of applied science. Like many new engineering projects some of the limitations to future progress depend on metallurgical difficulties. Problems arising in the construction of the large chemical plants for any nuclear power project are essentially the same in kind, although perhaps rather more acute in character, as those in normal chemical industry where dangerous and toxic chemicals are involved. On the other hand, the manufacture of fuels for nuclear reactors has required a new industry to be set up for the extraction of uranium, and other new metals are becoming increasingly important if progress is not to be retarded. Apart from new metals, new alloys and higher quality material in conventional metals have been required for the protection of uranium from attack by the coolants used. From the earliest days this has been one of the acute problems of nuclear energy. Finally the metallurgical problem peculiar to atomic energy is the development of materials which will withstand the effects of neutron irradiation. The effects on non-fissile materials are usually minor changes in physical properties, but on fissile material the effects are much more severe. At lower temperatures the anistropic nature of uranium results in large dimensional changes which are being overcome by grain refinement techniques involving alloying and heat treatment. At high temperatures the gaseous fission products tend to expand and disrupt the material by mechanisms which are not yet fully understood, and for which cures are still being developed. (auth)

1890

CHROMIUM RECRYSTALLIZATION DIAGRAM. E. M. Savitskii, V. F. Terikhova, and A. V. Kholopov. (Baĭkov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 109, 794-5(1956) Aug. 1. (In Russian)

A phase diagram was constructed for recrystallization of commercially pure electrolytic Cr. The chemical analysis of the Cr refined in hydrogen at 1350°, for 70 to 100 hr gave the following results (in %) Cr, 99.5; N, 0.1; C, 0.01 to 0.04; Si, 0.05; Fe, 0.1; Ni, 0.1; and O_2, 0.005. The microstructure of deformed and recrystallized specimens is shown. Tabulations are made of the Cr grain alterations and microhardness in relation to deformation and temperature of annealing. (R.V.J.)

1891

X-RAY EMISSION SPECTRA OF Mn AND Cu IN GEISSLER ALLOY WITHIN THE TEMPERATURE RANGE OF MAGNETIC TRANSFORMATION. E. E. Vaĭnshteĭn and B. I. Kotlyar. (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 110, 44-7(1956) Sept. 1. (In Russian)

Investigations were made of the shape and position of Mn and Cu K β-group lines in alloys similar in content to Cu_2MnAl, and of the corresponding characteristics of $K\alpha_1$ and $K\alpha_2$ lines for the above elements in a wide range of changing temperatures. The alloy was prepared from electrolytic Mn, Cu, and Al, thermally treated at 800° with subsequent quenching. Tabulations are given for Mn and Cu K β-group lines for alloys in paramagnetic and ferromagnetic states. (R.V.J.)

1892

APPLICATION OF AUTORADIOGRAPHY BY α TRACKS TO THE ANALYSIS OF U–Zr ALLOYS AND TO U–Zr DIFFUSION. Henriette Faraggi, Arlette Garin-Gonnet, Yves Adda, and Jean-Marie Henry. Compt. rend. 243, 1316-19(1956) Oct. 29. (In French)

The study of the γ emission in a thick shell of a certain number of U–Zr alloy has allowed the establishment of an experimental relationship between this emission and the U content. This relation allows the measurement of the U concentration in unknown alloys and has been used in the study of U–Zr diffusion. (tr-auth)

1893

CONSTITUTIONAL DIAGRAM OF BINARY TITANIUM–ALUMINUM ALLOYS. I. I. Kornilov, E. N. Pylaeva, and M. A. Volkova (Baĭkov Inst. of Metallurgy). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 771-8(1956) July. (In Russian)

The Ti–Al constitution diagram was studied to determine the microstructure, microhardness, and the thermal resistance of the alloy. A pyrotechnic reaction β + melt $\rightleftarrows \gamma$ took place at 1520° with 29.9 and 37.5% Al; γ + melt $\rightleftarrows$ $Ti-Al_3$ at 1400° with 60 to 64% Al; and, $\beta + \gamma \rightleftarrows \gamma$ at 1300° with 26 to 35% Al. The temperature of α-phase transformation into β phase increased from 87% with 0% Al to 1300° with 21.6% Al. The Ti–Al alloy hardness increased with larger amount of Al fused into the Ti α phase. In the γ phase the hardness of the alloy was considerably weaker than in the α-hard solution. The alloy heat resistance improved with a higher concentration of Al in the α-hard solution of Ti. (R.V.J.)

1894

ALTERATIONS IN MACROSTRUCTURE AND CATALYTIC ACTIVITY OF ALUMINUM OXIDES UNDER COMPRESSION AND WATER VAPOR TREATMENT. I. E. Neĭmark, L. Kh. Freĭdlin, A. I. Rastrenenko, and N. V. Borunova (Zelinskiĭ Inst. of Organic Chemistry). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 784-9(1956) July. (In Russian)

Investigations were made of alterations in macrostructure and catalytic activity of Al oxides under 20,000 atm compression and vapor processing. (R.V.J.)

1895

STUDIES OF QUINARY NICKEL–CHROMIUM–TUNGSTEN–TITANIUM–ALUMINUM SYSTEM. I. I. Kornilov, L. I. Pryakhina, and O. V. Ozhimkova (Baĭkov Inst. of Metallurgy). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk. 885-8 (1956) Aug. (In Russian)

Constitution diagrams were constructed of Ni–Cr–W–Ti–Al alloys in solid nickel solutions. Polythermal cross sections were constructed for the system with different contents of Al, Ti, and W and some physical properties (microstructure, hardness, specific electroresistance, and thermal resistance) were analyzed. (R.V.J.)

1896

EFFECTS OF THERMAL AND MECHANICAL TREATMENTS ON THE HEAT FACTOR OF HARD SOLUTION X-RAY SCATTERING. V. A. Il'ina, V. K. Kritskaya, G. V. Kurdyumov, and T. I. Stelletskaya (Inst. of Metals and Metal Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 723-8(1956) July. (In Russian)

Studies were made of thermal treatment and deformation effects on the interatomic bond forces in iron crystals binary alloyed with Cr, Ni, Mn, and W. (R.V.J.)

1897

ELECTRONOGRAPHIC INVESTIGATION OF OXIDE FILM FORMING ON LIQUID ALUMINUM AND ITS ALLOYS. M. V. Maltsev, Yu. D. Chistyakov, and M. I. Tsypin (Kalinin Moscow Inst. of Non-Ferros Metals and Gold). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 824-6(1956) July. (In Russian)

Investigations were made of the oxide film $\gamma-Al_2O_3$ forming in molten high-purity 99.9°Al, binary alloys: Al–Cu,

Al–Mg, Al–Zn, Al–Mn, Al–Si, Al–Fe, and some more complex commercial Al alloys containing Be, Li, Mg, Ca, and Sr. Nichroml rings were used to skim the film from the surface of the molten bath of Al and its alloys at 660, 670, 680, 690, 700, 800, 900, 1000, and 1100°C. It was found that oxide films formed during concentrations of more chemically active metals (Li, Be, Mg, Po, and Sr) had a two-phase structure, and depending on the nature of the oxides, the film of the base alloy became either stronger or weaker, thus, improving or reducing the anticorrosion resistance of the alloy. (R.V.J.)

1898

ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. I. GENERAL SURVEY. Abner Brenner (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 103, 652-56(1956) Dec.

1899

ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. II. FURTHER STUDIES ON THE ELECTRODEPOSITION OF ALUMINUM FROM A HYDRIDE BATH. Jean H. Connor and Abner Brenner (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 103, 657-62(1956) Dec.

1900

FLOATING ZONE PURIFICATION OF ZIRCONIUM. G. D. Kneip, Jr., and J. O. Betterton, Jr., (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 103, 684-9(1956) Dec.

The Fe and Ni contents of iodide Zr have been reduced to less than 2 ppm by the floating zone refining technique. The α/β transformation takes place over a temperature interval of 865 to 873°C in the purified material instead of the 16 to 70°C intervals found in grade 1 crystal bar. Fe and Ni distributions after multiple pass refining have been established by neutron activation analyses and the values agree with those calculated by the theory. (auth)

1901

THE SYSTEM URANIUM–PALLADIUM. J. A. Catterall, J. D. Grogan, and R. J. Pleasance (National Physical Lab., Teddington, Middlesex, England). J. Inst. Metals 85, 63-7 (1956) Oct.

In the U–Pd system the liquidus shows a eutectic between uranium and UPd at 998 ± 3°C., a maximum corresponding to the formation of UPd_3 at approximately 1640°C., and a minimum at 1305 ± 5°C. and 72 wt.-% palladium. The compound U_5Pd_6 forms by peritectic reaction from UPd_3 at 1110 ± 10° C., and the compound UPd by peritectic reaction from U_5Pd_6 at 1047 ± 7°C. U_5Pd_6 decomposes into UPd and UPd_3 at 980 ± 5°C. and UPd decomposes into uranium and UPd_3 at 970° ± 5°C. Palladium depresses the $\gamma \rightleftarrows \beta$ uranium transformation to 756 ± 4°C., but leaves the $\beta \rightleftarrows \alpha$ transformation unaffected. The maximum solubility of palladium in γ-uranium is 2.3 wt.-%, but the solubility is less than 0.14 wt.-% in the β and α forms. Palladium dissolves up to 38 wt.-% uranium in the δ solid solution, which forms from UPd_3 by peritectic reaction. The crystal structure of UPd_3 is of the type Do_{24}. (auth)

1902

SOME EXPERIMENTS ON THE DETERMINATION OF THE LATENT HEATS OF TRANSITION OF TITANIUM AND IRON. T. H. Schofield (National Physical Lab., Teddington, Middlesex, England). J. Inst. Metals 85, 68-70(1956) Oct.

The latent heats of the $\alpha \rightarrow \beta$ transition in titanium and the $\alpha \rightarrow \gamma$ transition in iron have been determined by a method which depends on the constancy of the products of the rates of heating and the times of transformation, and a knowledge of the specific heats. The result obtained for iron (218 cal./g.-atom) agrees well with accepted values; that for titanium (813 cal./g.-atom) is more closely in accordance with a recently determined value by Backhurst (880 cal./g.-atom) than with one derived earlier by McQuillan (680 cal./g.-atom). (auth)

1903

EFFECTIVE USE OF RADIATION AND THERMAL SHIELDS IN A VACUUM FURNACE. Yoshikazu Ishikawa and Shozo Sawada (Univ. of Tokyo). J. Phys. Soc. Japan 11, 1184-90 (1956) Nov.

A method for calculating the efficiency of several sheets of thick radiation shields with finite thermal conductivity is presented. It is shown that in case of shields having infinite conductivity, the efficiency and temperatures of the shields are expressed by simple formulas. It is shown by several examples of this method of calculations that the most important factors for the efficiency are found to be emissivity, thermal conductivity of the innermost shield, and its position. Effectiveness of a shield with small conductivity, which we call "thermal shield" in this paper, especially at high temperature is emphasized. Several experimental results are shown; they agree satisfactorily with the calculations. (auth)

1904

THE TEMPERATURE DEPENDENCE OF THE ELECTRICAL RESISTIVITY OF THE β-PHASE TITANIUM–MOLYBDENUM ALLOYS. Susumu Yoshida and Yûko Tsuya (Government Mechanical Lab., Tokyo). J. Phys. Soc. Japan 11, 1206-7(1956) Nov.

The electrical resistivity of the β-phase Mo–Ti alloys is given from -200 to 900°C. The curves of the data resemble those of Ni–Cr, Ni–Cu, Ni–Cu–Zn, and Cu–Mn alloys. (T.R.H.)

1905

A NEW APPROACH TO HOT TEARING. C. F. Christopher (Blaw-Knox Co., East Chicago, Indiana). J. Metals 8, 1654-7(1956) Dec.

1906

LOW MANGANESE STEELS FOR NUCLEAR APPLICATIONS. H. F. Beeghly (Westinghouse Electric Corp., Pittsburgh). J. Metals 8, 1664-70(1956) Dec.

Experimental carbon steels made with no manganese addition and residual manganese contents of the order of 0.10 to 0.15 pct have been made by standard open hearth practice and rolled with commercial equipment and procedures into plate and seamless pipe. The products when tested by ASTM methods met the mechanical property requirements for comparable grades with normal manganese contents. Elevated temperature tensile data show the low manganese steels to be free from strain aging and stronger and more ductile at elevated temperatures than comparable standard grades. Weldability of the low manganese steels is equal to or better than that of comparable standard grades. (auth)

1907

Fe–Al–Mo ALLOYS FOR HIGH-TEMPERATURE USE. J. F. Nachman and W. J. Buehler (U. S. Naval Ordinance Lab., Silver Spring, Md.). Metal Progr. 70, No. 6, 107-10 (1956) Dec.

The light weight, excellent oxidation resistance, and high strength at elevated temperature of Al–Fe–Mo alloys indicate their potential utility as replacements for Cr–Fe and Cr–Fe–Ni alloys in aircraft structural materials. (auth)

1908

PROPERTIES OF TITANIUM MELTED UNDER HIGH VACUUM. R. L. Folkman and M. Schussler (Electro Metallurgical Co., Niagara Falls, N. Y.). Metal Progr. 70, No. 6, 111-14(1956) Dec.

The ductility and notch toughness of Ti melted under vacuum pressures in low-micron range are found to be appre-

ciably better than those of Ti melted under the usual vacuum pressure in low-millimeter range. (auth)

1909

MULTIPLE CRUCIBLE ARC MELTING FURNACE. S. T. Zegler and J. Terandy (Argonne National Lab., Lemont, Ill.). Metal Progr. 70, No. 6, 116, 118(1956) Dec.

The unique features of an arc furnace for melting seven different alloys in one charging cycle are described. (auth)

1910

A PRELIMINARY STUDY OF THE FATIGUE OF METALS IN LIQUID METAL ENVIRONMENTS. J. W. Martin and G. C. Smith (Univ. of Cambridge, England). Metallurgia 54, 227-32 and 238(1956) Nov.

The results of fatigue tests at room temperature on amalgamated Cu alloy and at 300°C on mild steel and stainless steel in contract with liquid Sn and liquid Na are discussed. (J.E.D.)

1911

RARE EARTHS IN STEEL CASTINGS. W. J. Jackson. Metallurgia 54, 233-8(1956) Nov.

The application of rare earths in cast steels improve the ductility and impact properties, reduces susceptibility to hot tearing, and increases fluidity. Hardenability and weldability appear to be unaffected. (auth)

1912

FABRICATION AND WELDING TECHNIQUES FOR ATOMIC ENERGY PLANT. Nuclear Eng. 1, 378-82(1956) Dec.

Development work carried out on the design and fabrication of heat exchangers and pressure vessels is given. The welding of heavy steel plates is described, with survey and testing requirements. With stainless-steel fabrications and pipe-work, welding tolerances are extremely fine. (auth)

1913

THE HEAT CAPACITIES OF CHROMIUM AND NICKEL. J. A. Rayne and W. R. G. Kemp (National Standards Lab., Sydney, Australia). Phil. Mag. (8) 1, 918-25(1956) Oct.

Heat capacity measurements have been made below 4.2°K on extremely pure specimens of Cr and Ni. In both cases the measurements give γ values lower than those obtained by former observers. The values of Debye temperature also differ significantly from those of previous work, it being found that $\theta = 630$°K for Cr and $\theta = 440$°K for Ni in contrast to the older figures of 418 and 413°K respectively. These new results help to resolve the apparently anomalous nature of the θ versus T curves for the two metals. The influence of the magnetic heat capacity on the results for nickel is also discussed. (auth)

1914

THE MAGNETIC SUSCEPTIBILITIES OF PALLADIUM–URANIUM ALLOYS. L. F. Bates and S. J. Leach (Univ. of Nottingham, England). Proc. Phys. Soc. (London) B69, 997-1005(1956) Oct.

Measurements are made of the paramagnetic susceptibilities of Pd–U alloys covering the range of solid solution, of an intermetallic compound Pd_3U and of specimens of very pure Pd and U over the temperature range 77 to 293°k. Increasing amounts of U cause a rapid decrease of susceptibility up to a concentration of 9 at.%. Further increase in the amount of U causes a rapid rise in susceptibility, alloys of concentrations greater than 12 at.% obeying a Curie–Weiss law with an effective atomic moment of 3.14 Bohr magnetons. The results are discussed in relation to the properties of the Pd–Ag system and close similarity is found for low concentrations assuming that U is six times more effective than Ag. The temperature-dependent susceptibilities of the alloys of higher U content are explained by a change in the valency of U leaving two unpaired electrons localized on U atoms. An annealed alloy of concentration 17.6 at.% U showed an unexplained time dependence of susceptibility. (auth)

1915

THE HEATS OF FORMATION OF BORIDES OF SOME TRANSITION METALS. G. V. Samsonov (Moscow Inst. of Non-Ferrous Metals and Gold.). Zhur. Fiz. Khim. 30, 2057-60(1956) Sept. (In Russian)

Approximate values have been obtained for the heats of formation of Ti, Zr, Nb, Ta, and Cr diborides. (R.V.J.)

1916

EFFECTS OF WATER VAPORS ON METAL RESISTANCE TO CHLORINE CORROSION. Kh. L. Tseĭtlin (Voroshilov Inst. of Organic Semi-products and dyes). Zhur. Priklad. Khim. 39, 1182-91(1956) Aug. (In Russian)

Tests showed the following maximum temperatures for satisfactory metal resistance to chlorine corrosion in presence of water vapors, for: Al—450°; Fe—375°; steel—375°; stainless steel—475°; Ni—375°; Pb—225°; and Ta—400°. (R.V.J.)

1917

EFFECTS OF HYDROFLUORIC ACID AND HYDROGEN PEROXIDE MIXTURES ON NIOBIUM AND TANTALUM. G. I. Barannikov (Molotov Pharmaceutical Inst.). Zhur. Priklad. Khim. 39, 1283-7(1956) Aug. (In Russian)

Tests showed that the most effective solubility of metals was achieved in mixtures in which the H_2O_2 did not exceed 10% by weight of Nb and 15% by weight of Ta. The solubility of Nb and Ta in the mixtures of $HF-H_2O_2$ proved to be as effective or even slightly better than in the similar mixtures of $HF-HNO_3$. Effective chemical results were obtained in testing the $HF-H_2O_2$ with W, Re, Os, Pb, Pa, Mo, Au, V, Ti, and others. (R.V.J.)

1918

EFFECTS OF MOLTEN Li, Na, AND K NITRATES ON Ni, Cu, DURALOY, AND SOME TYPES OF STEEL. E. I. Gurevich. Zhur. Priklad. Khim. 39, 1358-65(1956) Sept. (In Russian)

Quantitative data of the parallel tests made with the above metal and alloys in melts, vapors, and at the border of the two phases have been obtained and the relation of the temperature and time on the rate of the metal corrosion in the molten nitrates of alkali metals has been found. The effects of alkali metal nitrate action on the parallel process of metal diffusion and film formation of the tested metals have been determined. (R.V.J.)

1919

TANTALUM AUTOELECTRON EMISSION. M. I. Elinson and G. F. Vasil'ev. Zhur. Tekh. Fiz. 26, 1669-70(1956) Aug. (In Russian)

Results are given of autoelectron emission of Ta at elevated temperatures. (R.V.J.)

PHYSICS

1920 NP-6155

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 43 FOR [PERIOD ENDING AUGUST 31, 1956.]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Oct. 15, 1956. 43p. Project 102B; DA-3-99-10-022. Contract DA36-039-SC-64637.

Detailed reports of the progress made in physical electronics, microwave gaseous discharges, nuclear magnetic

resonance and hyperfine structure, microwave electronics, statistical communication theory, processing and transmission of information and speech analysis are given. Summaries of the programs on microwave spectroscopy, atomic beams, transistor circuits and sensory replacement are included. (For preceding report see NP-6081.) (F.S.)

1921 NRL-4858

Naval Research Lab., Washington, D. C.

EXACT AND APPROXIMATE TREATMENTS OF THE ONE-DIMENSIONAL BLAST WAVE. E. G. Harris. Oct. 12, 1956. 14p.

A completely analytic solution is presented for a one-dimensional strong blast wave in a perfect γ-law gas. On the basis of qualitative information obtained from this exact solution, approximate expressions are derived for the dependence of the shock radius on time, total energy, and ambient density. These approximate expressions are applicable in any number of dimensions. The effects of ionization and dissociation on the properties of the blast wave are considered in a semiquantitative manner. (auth)

1922 ORNL-2188

Oak Ridge National Lab., Tenn.

SOLID STATE DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 30, 1956. Dec. 17, 1956. 129p. Contract W-7405-eng-26. $0.65(OTS).

Developments are reported in solid state reactions, engineering properties, radiation metallurgy, chemical effects of nuclear reactions, low-temperature metal physics, and other solid state studies. (For preceding period see ORNL-2051.) (T.R.H.)

1923 UCRL-3524

California. Univ., Berkeley. Radiation Lab.

PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, JULY 1956. Aug. 20, 1956. 44p. Contract W-7405-eng-48. $0.30(OTS).

1924 WT-1197

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

TECHNICAL PHOTOGRAPHY: (HIGH SPEED—BLAST BIOLOGY). M. A. Balmer and R. S. Harper. Dec. 1955. 25p. Project 39.4b [of] Operation Teapot. $0.25(OTS).

Photographic techniques are described which were used in studies on the biological phenomena of blast. Experimental animals were exposed to the effects of an atomic explosion. Preshot and postshot photographs of animals and structures, photographs of gross specimens obtained at the time of autopsy of experimental animals, and high-speed motion picture sequences of group-shelter interiors containing animals were made. Several conclusions were drawn regarding changes necessary to better assure results under extreme circumstances. (C.H.)

1925

PREPARATION OF THIN BETA-RAY SOURCES BY EVAPORATION AND CATHODE SPUTTERING. Tihomir M. Novakov and Milorad S. Mladjenović. Bull Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 69-73(1956) Mar.

A description is given of a new method of preparation of thin β sources, based on the cathode sputtering. The results for Ir and Eu are given. A graphite oven, convenient for the thermal evaporation at high temperature, is also described. (auth)

1926

A STUDY OF THE HYDROGEN-PRESSURE RELATIONSHIPS IN THE ZIRCONIUM–HYDROGEN SYSTEM. C. E. Ells and A. D. McQuillan (Univ. of Birmingham, England). J. Inst. Metals 85, 89-96(1956) Nov.

Measurements of hydrogen equilibrium pressure for a series of zirconium–hydrogen alloys in the composition range 1 to 44 at.-% hydrogen at temperatures between 500 and 950°C have been used to deduce the form of part of the constitutional diagram for the zirconium–hydrogen system. Additions of hydrogen have been shown to cause a depression of the $\alpha-\beta$ transformation in zirconium. A eutectoid point at which the β solid solution is in equilibrium with the α solid solution and a hydrogen-rich phase occurs at 550°C and 32 at. % hydrogen. The maximum solubility of hydrogen in α-zirconium is 6 at. %. It has been observed in the course of the work that small additions of hafnium (approx. 1.5 at. %) cause a depression of the transformation temperature in zirconium, and it is concluded that the $(\alpha + \beta)$ region in the zirconium–hafnium system must, therefore, pass through a minimum point. A reconsideration of the experimental results on the zirconium–oxygen–hydrogen system in the light of the present results and of Phase-Rule considerations has resulted in a proposed revision of the isothermal section of the constitutional diagram at 750°C. (auth)

1927

THEORY OF KINETIC PHENOMENA IN HELIUM II. I. M. Khalatnikov. Uspekhi Fiz. Nauk 59, 673-753(1956) Aug. (In Russian)

Calculations were made to determine the relation of helium viscosity to the temperature. In temperatures below the λ point, helium II possesses a remarkable property of "superfluidity". At absolute zero helium is in a stable state, but at any other temperature it is in a state of excitation. Each helium excitation state is an aggregate of elementary excitations similar to the ones which occur in a solid crystal, where the thermal atomic oscillations in the lattice may be expressed as an aggregate of phonons. The bond between the energetic excitation spectra with structural factors of liquid helium was analyzed. The thermodynamic functions and normal density of helium were measured. Investigations were made of helium elementary excitation interactions with one another, of the energetic spectrum phonon dispersions, of the phonon scattering by phonons, of the scattering of phonons by rotons, and the roton scattering by rotons. The absorption and emission of photons and rotons and the equilibrium in phonon gas was established. Detailed analysis of the kinetic equations for elementary excitation of helium revealed that helium II is specified by a coefficient of first viscosity and by three coefficients of secondary viscosity. Helium II also possesses the coefficient of heat conductivity which links the temperature gradient with the stream of heat. (R.V.J.)

1928

CONSIDERATIONS AFFECTING FUTURE PRESSURE-VESSEL CODES. J. J. Murphy, C. R. Soderberg, Jr., and D. B. Rossheim (M. W. Kellogg Co., New York). Welding J. (N. Y.) 35, 582s-96s(1956) Dec.

Code requirements for pressure vessels are presently associated with extremely ductile materials and safety factors sufficiently ample to limit consideration to principal stresses evaluated by simple formulas. Advancements in physics have extended present knowledge of the fundamental behavior of metals, and metallurgical progress has provided new, improved, and special-purpose materials, many with physical properties enhanced b chemistry, heat treatment, or cold work with concurrent reduced ductility. The horizons of both analytical and experimental stress analysis have been vastly extended. Also new and improved inspection techniques and equipment are available. Since World War II, pressure vessel demands of the process, power, and other industries have rapidly increased in number, size, and complexity. In many cases this requires more precise design and fabrication, with attendant justifi-

cation of lower safety factors and improved economics. This trend toward balanced or adequately proportioned pressure vessels is further accentuated by new critical materials whose greatly increased cost justifies the objective of higher working stresses as obtained from improved design, fabrication, materials, and inspection. Tentative basis principles for revision of the ASME pressure-vessel codes to a broader base to suit the wide variations in service and economic demands are indicated. (auth)

AEROSOLS

1929

ON THE EFFECTS ON AIR IONIZATION ON THE DISPERSED PHASE OF AEROCOLLOIDS. K. M. Merzhanov, N. I. Peterimova, and N. S. Smirnov (Moscow Inst. of Geophysics). Kolloid. Zhur. 18, 574-7(1956) Sept.-Oct. (In Russian)

Experiments showed that increased ionization of the dispersion medium increases the concentration of the dispersed phase of aerocolloids. For the concentration of up to 10^6 to 10^7 ionic pairs in the regular atmosphere, with relative humidity of not over 100%, the concentration of ultramicroscopic particles increased 3 to 4 times and the number of nuclear condensation more than 10 times. (R.V.J.)

ASTROPHYSICS

1930

SIMULATION OF SOLAR PROMINENCE IN THE LABORATORY. Winston H. Bostick (Univ. of California Radiation Lab., Livermore). Phys. Rev. 104, 1191-3(1956) Nov. 15.

Experimental observations are used to postulate the field and current configurations of magnetohydrodynamic whirl rings in sunspots. (D.E.B.)

COSMIC RADIATION

1931

OBSERVATION OF THE HIGH-ENERGY PROTON-PROTON COLLISION IN PHOTOGRAPHIC EMULSION. Shin-ichi Kaneko, Osamu Kusumoto, and Shigeo Matsumoto (Osaka City Univ., Japan). J. Phys. Soc. Japan 11, 1129-35(1956) Nov.

The tracing-back method has been applied to the detection of showers which could be regarded as those produced by single nucleon-nucleon collisions in a stack of stripped emulsions exposed at the stratosphere. The method consists in t[illegible]ing star-producing tracks back along their passage t[illegible]h successive emulsion strips and in finding primary [illegible]ctions. It enabled us to detect the interactions without any bias irrespective of the number of accompanyin[illegible]vaporation prongs. A shower of the type $1 + 5_p$ detected by this method in a preliminary observation was analysed in terms of the single proton-proton collision. By the assumption of balance of transverse momenta for the charged outgoing particles alone, the incoming proton energy was estimated to be about 25 Bev and the inelasticity to be about 0.4. The results and another possible estimates have been presented together with a brief description of some features of the shower. (auth)

1932

ABSOLUTE INTENSITY OF LOW-ENERGY COSMIC-RAY μ MESONS. A Fafarman (New York Univ.). Phys Rev. 104, 1116-19(1956) Nov. 15.

A cylindrical plastic scintillator weighing one kilogram has been used as both the absorber and the detector for the stopping of (omnidirectional) low-energy cosmic-ray μ mesons. Simultaneous delayed coincidences in each of two photomultipliers that view the scintillator serve to identify the decays of stopped mesons. A correction is made for mesons that decay outside the recorded delay intervals. A further correction is made for edge effects (decay beta particles which escape from the scintillator with insufficient energy loss to actuate the detector). The number of stopping mesons of average range 7 g per.cm^2 (air equivalent) is $7.29 \pm 0.21 \times 10^{-4}$ sec^{-1} g^{-1}. Assuming a $\cos^3\theta$ distribution yields for the vertical intensity $4.64 \pm 0.13 \times 10^{-4}$ g^{-1} sec^{-1} sterad^{-1}. (auth)

1933

COSMIC-RAY PRODUCTION RATE AND MEAN REMOVAL TIME OF BERYLLIUM-7 FROM THE ATMOSPHERE. Paul A. Benioff (Tracerlab Inc., Richmond, Calif.). Phys. Rev. 104, 1122-30(1956) Nov. 15.

1934

THE MOMENTUM SPECTRUM OF μ-MESONS AT A DEPTH OF 40 METRES WATER EQUIVALENT. W. F. Nash and A. J. Pointon (Univ. of Nottingham, England). Proc. Phys. Soc. (London) A69, 725-33(1956) Oct.

Scattering distributions, obtained in two lead plates, each 2 cm thick, placed in a cloud chamber situated at a depth of 40M water equivalent, have been used to determine the momentum spectrum of μ mesons in the range 0.22 to 1.0 bev c^{-1}. The spectrum is in good agreement with the spectrum derived from the sea level data of Holmes and co-workers. (auth)

1935

SUPERNOVA ORIGIN OF COSMIC RAYS. Satio Hayakawa (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 15, 111-21(1956) Feb.

The supernova origin of cosmic rays is proposed in connection with the stellar evolution and the building up of heavy elements in the core of stars as they evolve. Nearly equal abundances of heavy and medium nuclei in primary cosmic rays suggest that the sources may be such stars, in which the thermonuclear reactions of building up heavy elements take place and which eventually explode as supernovae. The light elements, Li, Be, and B, in galactic matter are considered to be generated by the nuclear bombardment of heavier nuclei at the explosion. The number of cosmic ray particles injected there is estimated in reference to the radio emission of supernova remnants. If the number injected is of the order of 10^{51} per supernova and the explosion is more frequent than now observed, the supernova origin is shown to be not inconsistent with cosmic ray as well as astronomical evidences. The galactic model suitable to our interpretation is a sphere with magnetic clouds. The life time of cosmic rays in this galaxy is estimated to be of the order of 10^8 years, corresponding to the fact that the mean thickness of interstellar matter traversed by cosmic rays is about 1 g cm^{-2}, that is estimated from the abundance of the light nuclei in the primary cosmic rays. (auth)

1936

MESON COMPONENT OF THE COSMIC RADIATION AT AN ALTITUDE OF 3200 m ABOVE SEA LEVEL. N. M. Kocharian, M. T. Aivazian, Z. A. Kirakosian, and A. S. Aleksanian (Inst. of Physics, Armenian SSR). Soviet Phys. JETP 3, 350-4(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 243-7(1956) Feb. (In Russian)

The momentum spectrum of μ mesons was measured in the momentum range $0.4 \leq p \leq 14$ Bev/c at an altitude of 3200 m above sea level. The ratio of the number of protons to μ mesons at this altitude wad determined. The ratio of positive to negative μ mesons was found as a function of momentum. (auth)

1937

THE HODOSCOPIC DELAYED COINCIDENCE METHOD AND ITS APPLICATION TO THE INVESTIGATION OF SLOW MESON FORMATION IN COSMIC RADIATION. G. B. Zhdanov (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 323-33(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 437-49(1956) Mar. (In Russian)

There is presented the basis of the hodoscopic delayed coincidence method of studying the processes of formation of slow π^+ mesons by the nuclear-active component of the cosmic radiation. Aside from describing the apparatus, an analysis of the various instrumental effects is carried out. An estimate is made of the effective energy of formation of the particles and also of the instrumental corrections, which must be taken into account in order to determine the energy spectrum and absolute intensity of formation of slow π^+ mesons. (auth)

1938

ENERGY SPECTRUM OF THE PENETRATING PARTICLES OF EXTENSIVE COSMIC RAY SHOWERS. I. I. Sakvarelidze (Georgian Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 3, 361-6(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 458-63(1956) Mar. (In Russian)

The depth-intensity curve of penetrating shower particles absorbed in lead and rock of water equivalent of 3.7, 5.9, 27, 65.5, and 148 meters has been measured. The studies are carried out at an elevation of 400 meters above sea level. On the basis of the resulting path lengths, the integral energy spectrum of penetrating shower particles is found in the form of a power function. This function has the form $E^{-\gamma}$, where $\gamma = 0.62 \pm 0.05$ (for the energy interval from 5×10^9 to 3×10^{10} ev). (auth)

1939

MESON FORMATION IN Pb, Cu, AND C NUCLEI BY COSMIC RAYS IN THE STRATOSPHERE. D. Kaipov and Zh. Takibaev (Kazakh Academy of Sciences). Soviet Phys. JETP 3, 385-9(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 471-6(1956) Mar. (In Russian)

The cross section for meson formation in various nuclei was studied. It was found that the cross section increases differently at high and low energies. (auth)

1940

PROGRESS IN COSMIC RAY PHYSICS. VOLUME III. J. G. Wilson, ed. New York, Interscience Publishers, Inc., 1956. 420p. Amsterdam, North-Holland Publishing Co.

The research is cosmic ray physics to early 1955 with some recent references is reviewed. Extensive air showers, experimental results on charged K-mesons and hyperons, decay processes of heavy unstable neutral particles and the energy balance of cosmic radiation are discussed, and the extent to which problems heavy mesons and hyperons were resolved using natural sources is reported. (F.S.)

ELECTRICAL DISCHARGE

1941

ON FORMATION OF THERMONUCLEAR REACTIONS IN GAS DISCHARGE. I. V. Kurchatov. Uspekhi Fiz. Nauk 59, 603-18(1956) Aug. (In Russian)

A review is given of some phenomena observed during strong impulse discharge in low-density gases. (R.V.J.)

1942

THE LEADING ROLE OF THE VIBRATION PROPERTIES OF PLASMA AND THE EFFECT OF THE GAS ATOMS ON THESE PROPERTIES. I. P. Bazarov (Moscow State Univ.). Soviet Phys. JETP 3, 453(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 426(1956) Feb. (In Russian)

1943

DEFORMATION OF ARC COLUMN IN RAREFIED GASES AT HIGH CURRENTS. G. G. Timofeeva and V. L. Granovskii (All-Union Electrotechnical Inst.). Soviet Phys. JETP 3, 437-49(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 477-87(1956) Mar. (In Russian)

Various phenomena occuring in the arc of Hg, H_2, A, and Kr at $p \sim 10^{-4}-10^{-3}$ mm Hg and currents i_a up to 2000 amp were studied. By the method of a movable probe it was found that the half width of the arc column decreases by 30% when the current i_a increases up to 10^3 amp. A further increase in current gives rise to gradually increasing vibrations first in the probe current, then in the arc voltage and finally, in the arc current, with an average frequency $f = 10^4$ to 10^5 cycles. The oscillograms of the current on two identical and symmetrically located probes show that these vibrations may be interpreted as the result of irregular propagation of the compressed arc column along the cross section of the tube. At current pulses $i_a \sim 500-2000$ amp with a duration of 1 to 10 μsec, it is possible to observe the compressed arc column visually and photographically; the column is found to be compressed into a narrow cord, curved into a helix and pressed against the walls of the tube. With the aid of a rotating photo-camera it was shown that, at prolonged (10^2 to 10^3 μsec) current pulses, the arc is also compressed and is repeatedly propagated along the cross section of the tube. The compression and the curvature of the arc column are of electrodynamic origin, but its propagation is of gasodynamic origin. (auth)

1944

ON THE PHOTOEMISSION AND SECONDARY ELECTRON EMISSION ADDITIVITY OF METALS. L. I. Ekertova. Zhur. Tekh. Fiz. 26, 1665-8(1956) Aug. (In Russian)

The total additivity of photoemissions and secondary electron emissions were measured on Mg and Al metals. The experiments revealed that the photoemission and secondary electron emission additivity remained unchanged with slightly oxidized metal surfaces. (R.V.J.)

1945

TANTALUM AND NICKEL ION EMISSIONS CAUSED BY POSITIVE CESIUM ION BOMBARDMENTS. V. I. Veksler and M. B. Ben'yaminovich. Zhur. Tekh. Fiz. 26, 1671-80 (1956) Aug. (In Russian)

ELECTRONS

1946 NARF-56-39T

Convair, Fort Worth, Tex.

SPECIFIC ENERGY LOSS AND FLUX TO DOSE CONVERSION FACTORS FOR NUCLEAR ELECTRONS. L. H. Deiterman. Oct. 31, 1956. 23p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-132).

A flux of electrons from a radioactive nucleus (hereafter referred to as nuclear electrons) passing through air at STP is considered. The average specific energy loss for nuclear electrons in air is calculated and is applied to wet muscle tissue. Then the nuclear electron flux necessary to produce 1 mrep of dose is calculated. The bremsstrahlung correction is shown to be negligible. The results contained in this report apply only to surface doses due to electrons emitted from "thin" sources. (auth)

1947

ENERGY DISTRIBUTIONS IN THE SPECTRUM OF INCOHERENT EMISSIONS OF ELECTRONS MOVING IN A SYNCHROTRONE. Yu. M. Ado and P. A. Cherenkov (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 110, 35-7 (1956) Sept. 1. (In Russian)

Emissions of electrons moving in a magnetic field were

investigated in previous works in which the optical characteristics of the emission were measured for the integral electronic emissions of the entire cycle of the acceleration. In the present work the measurements were taken of the relative distribution of monoenergetic electron emissions in the range of 150, 225, and 250 Mev; with spectra from 4000 to 6100 A. (R.V.J.)

1948

MAGNETIC QUENCHING OF 3-PROTON ANNIHILATION IN SOLIDS. V. L. Telegdi, J. C. Sens, D. D. Yovanovitch, and S. D. Warshaw (Univ. of Chicago). Phys. Rev. 104, 867-73(1956) Nov. 15.

It is shown experimentally that the rate of the 3-photon annihilation of positrons in amorphous insulators exhibiting a long-lifetime component in 2-photon decay (Teflon, fused quartz) is quenched in the presence of an external magnetic field, while the rate in aluminum is unaffected. This effect has been studied in fields up to 10^4 gauss. The results can tentatively be explained by a simple theory which assumes: (a) that in metals, all or most positrons do not form bound systems; (b) in amorphous insulators a certain fraction of positrons form 1S positronium, the rest annihilating directly; (c) in amorphous insulators such as Teflon and fused quartz, positronium atoms, or at least their ortho-variety, exhibit essentially vacuum intrinsic properties and are subject to a rapid destruction due to ortho ⇌ para conversion and/or "pickoff" annihilation. Besides the (vacuum) ortho and para annihilation rates, the sole parameter of this theory is the "conversion" rate γ. The values of γ determined from the present experiment agree within 10% with those required to explain the lifetimes observed in these materials by Bell and Graham. Accurate relative 3-photon annihilation rates have also been obtained: (Teflon/Al) = 3.08 ± 0.15; (fused quartz/Al) = 2.29 ± 0.09. (auth)

1949

SPECTRUM OF L AUGER ELECTRONS FROM $_{81}Tl^{208}$ AND $_{83}Bi^{212}$. J. Burde and S. G. Cohen (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 104, 1085-92(1956) Nov. 15.

A study of the L Auger spectrum emitted from a source of ThB in equilibrium with its decay products has been made by using a thin-magnetic-lens electrom spectrometer. The L Auger spectrum coincident with alpha particles has also been measured, and this has been ascribed mainly to $_{81}Tl^{208}$. Since the directly recorded L Auger spectrum is composed mainly from the L spectra of $_{81}Tl^{208}$ and $_{83}Bi^{212}$, the latter spectrum could be obtained by subtraction of the properly normalized alpha coincident spectrum from the directly recorded spectrum. The importance of the effect of nuclear recoil accompanying alpha emission on the shape and energies of the L Auger spectra is discussed and properly taken into account. The energies and intensities of fifteen lines are given for each spectrum, and a classification of these lines are made. From the experimental results the Auger and Coster-Kronig yields for the different L subshells were calculated. (auth)

1950

THE COMPTON EFFECT AT HIGH ENERGIES. A. A. Abrikosov (Institute of Physical Problems, U.S.S.R.). Soviet Phys. JETP 3, 474-83(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 386-98(1956) Feb. (In Russian)

The Compton effect is investigated at high energies. Those terms are analyzed which arise from diagrams giving the maximum power of $\ln(\omega/m)$ with each power of e^2. Such terms are of order $[e^2\ln^2(\omega/m)]^n$. Formulas are given for single and multiple Compton effect, for the distribution of secondary photons in energy and angle, and for the energy distribution of secondary electrons. At small angles a peculiar change in the scattering is found, which leads to a change in the refractive index of energetic photons in matter. (auth)

1951

BETA-SPECTROMETER INVESTIGATION OF CONVERSION ELECTRONS WITH AID OF NUCLEAR EMULSIONS. I. A. Antonova (Moscow State Univ.). Soviet Phys. JETP 3, 461-3(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 571-2(1956) Mar. (In Russian)

The feasibility of using thick emulsions for recording conversion electrons in a β spectrometer was discussed. Cs^{137} was the source of the electrons and the plates were NIKFI type R with a grain density of 30 to 40 per 100μ. The results were in good agreement with those obtained with β counters. (F.S.)

1952

SCATTERING OF HIGH-ENERGY ELECTRONS AND POSITRONS BY ELECTRONS. A. A. Abrikosov (Inst. of Physical Problems, U.S.S.R.). Soviet Phys. JETP 3, 379-84 (1956) Oct. (In English). Zhur Eksptl.' i Teoret. Fiz. 30, 644-50(1956) Mar. (In Russian)

The scattering of charged particles is considered in the energy region $V(\pi)/e \ll \ln(E/m) \ll \pi/e^2$. It is shown that the cross section for electron-electron scattering with arbitrary radiation does not differ from that given by zero-order approximation. For the positron-electron scattering the cross section is changed in the region of small angles. This change is determined by solving an integral equation. (auth)

1953

REFLECTION OF SLOW ELECTRONS FROM THE SURFACE OF PURE TUNGSTEN AND FROM TUNGSTEN COVERED BY THIN FILMS. N. D. Morgulis and D. A. Gorodetskii (Kiev State Univ., U.S.S.R.). Soviet Phys. JETP 3, 535-40(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 667-74(1956) Apr. (In Russian)

The reflection of slow electrons from the surface of both pure tungsten and tungsten covered with adsorbed films of Ba of various thicknesses, and of O, is investigated. Particular attention is given to achieving a very high vacuum in the experimental tubes so that the components of residual gases ($p_{eff} \approx 10^{-10}-10^{-11}$ mm) condensed on the surface could not have a measurable effect. The results of the experiments show an unusual dependence on the primary electron energy V_p of the coefficient of secondary emission R for pure W and O-W, and a large effect on R of the films of Ba adsorbed on W with a thickness smaller than, and of the order of a monatomic layer. The correct correlation is also obtained between the threshold of emission of the secondary electrons and the work function of the target. (auth)

1954

SECONDARY ELECTRON EMISSION FROM COPPER, GERMANIUM AND TIN IN SOLID AND LIQUID STATES. V. G. Bol'shov and V. K. Seleznev. Zhur. Tekh. Fiz. 26, 1657-64 (1956) Aug. (In Russian)

Measurements were made to find the coefficient for the secondary electron emission σ for Cu, Ge, and Sn in liquid and solid states, and to determine the energy distribution of secondary electrons from Sn. It was revealed that with temperature change from 20 to 232°C for Sn and to 1033°C for Cu, the σ_{max} changes only about 1%. For Ge, σ_{max} was lowered 5 to 6% with temperature change from 20 to 59°. It is shown that during smelting the σ_{max} changes suddenly, and the σ along the interval of primary electron energies from 100 to 150 ev have the same sign. The maximum coefficient values for the secondary electron emission σ_{max} for solid and liquid materials lay in the same primary electron energy levels U_{pmax}. At the melting point of U_{pmax} for Cu $\sigma_{liquid} > \sigma_{solid}$ 5%; $\sigma_{liquid} > \sigma_{solid}$ for Sn 14%; and, for Ge the $\sigma_{liquid} >$

σ_{solid} 9%. The investigation of the Sn secondary electron energy distributions showed that the increase in the yield of virtual secondary electrons caused an increase of the Sn σ during the transition into the liquid state. (R.V.J.)

1955

ON THE CONFIGURATION OF ELECTRON TRAJECTORIES IN A CYLINDRICAL MAGNETRON. B. Ya. Moĭzhes. Zhur. Tekh. Fiz. 26, 1836-40(1956) Aug. (In Russian)

Differential equations for electron motions in cylindrical, almost flat, magnetrons were developed, based on the method of small parameter with allowance for the volume charge. In larger than critical magnetic fields, the electron trajectories have various configurations depending on the electrode positions; in cases of concave cathodes the electrons return to the cathode while in cases of convex cathodes electrons move along the concentric periphery. (R.V.J.)

GASES

1956 KAPL-1612

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DIFFUSION OF ARGON IN A POTASSIUM–LIME–SILICA GLASS. M. B. Reynolds. Oct. 5, 1956. 25p. $0.25(OTS).

Diffusion coefficients for bulk diffusion of A in a potassium–lime–silica glass have been determined at temperatures ranging from 308 to 470°C by a radioactive counting technique. Argon diffusion was found to follow classical bulk diffusion theory within the limits of experimental accuracy. From a plot of log D vs 1000/T an activation energy of 42 Kcal/mol was obtained for the argon diffusion process. The activation energy and diffusion coefficients obtained are compared with values obtained for He and A by other workers who used the permeation technique. (auth)

1957 KAPL-M-LFE-10

Knolls Atomic Power Lab., Schenectady, N. Y.

THE SOLUBILITY OF HELIUM GAS IN LIQUID SODIUM. Leo F. Epstein. Oct. 30, 1951. Changed from OFFICIAL USE ONLY Nov. 30, 1956. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Equations are derived for the computation of the solubility of He in liquid Na from 450 to 900°F at one atmosphere pressure. (W.L.H.)

1958

APPROXIMATION FORMULA FOR PRESSURE AND INTERNAL ENERGY OF GAS IN THE GENERALIZED STATISTICAL THOMAS-FERMI ATOM MODEL. N. N. Yanenko. Doklady Akad. Nauk S.S.S.R. 109, 916-8(1956) Aug. 11. (In Russian)

1959

PERMEATION OF GASES THROUGH ELECTROLYTIC NICKEL DEPOSITS. II. DETERMINATION OF THE EFFECT OF SEVERAL VARIABLES ON THE INTRINSIC PERMEABILITY OF NICKEL DEPOSITS TO GASES. D. T. Ewing and J. Martin Tobin (Michigan State Coll., East Lansing) and D. Gardner Foulke (Hanson-Van Winkle-Munning Co., Matawan, N. J.). J. Electrochem. Soc. 103, 648-51(1956) Dec.

1960

STOPPING POWER OF VARIOUS GASES FOR LITHIUM IONS OF 100-450-kev KINETIC ENERGY. Samuel K. Allison and C. S. Littlejohn (University of Chicago). Phys. Rev. 104, 959-61(1956) Nov. 15.

The stopping power, expressed in ev per atom of gas per cm^2 has been measured in H_2, He, air, and A for Li^+ in the kinetic energy range 100 to 450 kev. Collisions which would have deviated the Li^+ as much as 10^{-3} radian would have removed them from the detector aperture, so that the measured stopping power arises entirely from electronic collisions. (auth)

1961

STRONG IMPULSE DISCHARGES IN GASES. S. M. Osovets and I. M. Podgornĭĭ. Vestnik Akad. Nauk S.S.S.R. 26, No. 8, 106-8(1956) Aug. (In Russian)

A review is given of the works on strong impulse discharges in gases performed by a group of physicists from 1951 to 1956 and reported at the Physico-Mathematical Science Conference June 12, 1956. (R.V.J.)

INSTRUMENTS

1962 KAPL-M-AME-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE TRANSIENT BURNOUT DETECTOR. Arthur Bushel. Nov. 27, 1956. 6p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

A design is offered for an instrument which will monitor fuel element temperature and will shut down a 20,000 amp generator before the element burns up. (T.R.H.)

1963 LA-2057

Los Alamos Scientific Lab., N. Mex.

RECOVERY OF THE 931-A PHOTOMULTIPLIER TUBE FROM SPACE-CHARGED SATURATION. Clarence W. Orr. Apr. 4, 1956. 31p. Contract W-7405-eng-36. $0.25(OTS).

The 931-A photomultiplier tube will recover from a space-charged saturation condition for short light pulses with intensities as high as two decades above that needed to saturate the tube. A further increase in light intensity, resulting in longer periods of saturation, causes a reduction in sensitivity of the tube after the period of saturation. (auth)

1964 NYO-7596

Rochester, N. Y. Univ.

A 75 KW MAGNETIC AMPLIFIER. Kurt Enslein. Apr. 26, 1956. 20p. Contract AT(30-1)-875. $3.30(ph OTS); $2.40(mf OTS).

Design is described of a 75 Kw magnetic amplifier to supply DC power to an electromagnet used for nuclear research. (C.H.)

1965 RIB-19

David Sarnoff Research Center, Princeton, N. J.

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. Quarterly Report No. 25 [for] August 1, 1956–October 31, 1956. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. 29p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 308. $4.80(ph OTS); $2.70(mf OTS).

The improvement in uniformity and probability of success in activating secondary emission dynodes based on Ag–Mg was studied. A new multiplier structure was brought to the place where a high speed large scale model can be built. The time error introduced by transit time spread in the photo cathode-to-first dynode region was reviewed and the continuation of the transit time spread measurements in multiplier structures in use and proposed is discussed. (For preceding report see RIB-17.) (F.S.)

1966

A CURRENT INTEGRATOR AND INDICATOR WITH AN INDUCTION WATTHOURMETER. Dimitrije A. Tjapkin and Radivoje P. Ilić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 99-104(1956) Mar.

An integrator is described which uses an induction type

watthourmeter as integrating element. Range of the instrument from 5×10^{-9} to 5×10^{-3} A; precision ± 2.5%. (auth)

1967

A SIMPLE TEN CHANNEL AMPLITUDE ANALYSER. Velimir N. Kostić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 105-11(1956) Mar.

A ten channel analyzer is described which uses 2.5 amplifying tubes per channel and one double diode. The window amplifier which sends pulses to the analyzer has three amplifications: 10.5 and 3.5, which corresponds to the channel widths of 0.7, 1.4 and 2 v, respectively. The window amplifier accepts the pulses having a rise-time of 0.5 to 100 μsec, while the linearity is better than ± 23%. The resolving time of the analyzer is 3 μsec. (auth)

1968

RECORDING VACUUM ROENTGEN SPECTROGRAPH (FOR 20 TO 300 A DISTANCE RANGE). A. E. Efremov and A. M. Tyutikov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 794-7(1956) July. (In Russian)

Descriptions are given of a spectrograph used for x-ray absorption analysis, however, the apparatus is also equipped for emission and fluoresence analysis. Schematic diagrams of the spectrograph and the x-ray receiver are presented. (R.V.J.)

1969

UNIVERSAL ROENTGEN VACUUM TABULAR SPECTROGRAPH. I. B. Staryĭ (Ushinskiĭ Odessa Pedagogic Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 798-800(1956) July. (In Russian)

Descriptions are given of the design and principle of an x-ray vacuum tubular spectrograph. (R.V.J.)

1970

ABOUT A SIMPLE METHOD FOR THE OBSERVATIONS OF THE PHOTOIONIZING X-RAY ACTIONS UNDER AN ATMOSPHERIC PRESSURE. M. E. Gurevich (Kirgiz Agricultural Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 843-4(1956) July. (In Russian)

A simple instrument consisting of two plates, (one iron or aluminum, the other copper), connected by a galvanometer was used for rough dosimetric measurements under various conditions. The scheme and the results of measurements are described. (R.V.J.)

1971

EXPERIMENTS WITH AN AUTOMATIC TRANSLATOR ON ELECTRONIC CALCULATING MACHINE BESM. G. P. Zelenkevic, L. N. Korolev, and S. N. Razumovskiĭ (Inst. of Precision Mechanics and Computing Techniques Akad. of Science S.S.S.R.). Priroda 45, 81-5(1956) Aug. (In Russian)

Descriptions are given of the principle and scheme of the automatic translation machine, translating from English into Russian. (R.V.J.)

ISOTOPES

1972

PREPARATION OF CARRIER FREE RADIOACTIVE PHOSPHORUS-32. Olga Ž. Kovačević and Smilja M. Stanković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 159-61(1956) Mar.

The preparation of carrier free radioactive P^{32} from the neutron irradiated CS_2 is described. The water extraction gives a yield of 71%, while the distillation of CS_2 combined with water extraction of P^{32} yields 82%. The procedure described requires only about three hours and the apparatus is very simple. The radioactive P^{32} produced in such a way can be used for biological purposes in the form of water solution of orthophosphate. (auth)

1973

SOME UPPER LIMITS OF ISOTOPIC ABUNDANCE — II: Ne, Cl, and Ga. Larkin Kerwin and D. E. McElcheran (Department de Physique, Université Laval, Quebec, Que.). Can. J. Phys. 34, 1497(1956) Dec.

1974

ENRICHMENT OF RADIOACTIVE ISOTOPES OF MERCURY. V. D. Nefedov, E. N. Sinotova, and V. I. Katsapov (Zhdanov Leningrad State Univ.). Zhur. Fiz. Khim. 30, 1867-70 (1956) Aug. (In Russian)

The enrichment of mercury was achieved by using the recoil phenomena in radiative neutron capture to the radioactive isotopes of mercury. The enrichment was carried out with diethyl mercury, twice distilled in vacuum, as the initial compound. The method of isolating the radioactive mercury isotopes from slow-neutron-bombarded compounds consisted in adsorptive capture of recoil atoms by MnO_2 precipitates. An enrichment factor of 2.5×10^5 with 67% yield of radioactive Hg was attained. (R.V.J.)

1975

ENRICHMENT OF RADIOACTIVE ANTIMONY ISOTOPES WITH THE AID OF TRIPHENYLANTIMONY DIFLUORIDE BY THE ATOMIC RECOIL METHOD. V. D. Nefedov and L. N. Evtikheev (Leningrad State Univ.). Zhur. Fiz. Khim. 30, 2090-2(1956) Sept. (In Russian)

A method has been developed for the enrichment of Sb^{122} by using $Sb(C_6H_5)_3F_2$ as the initial compound. The method permitted an enrichment factor of $\sim 10^5$ with yield of ~40 to 45%. Preliminary studies were made on the forms of radioactive antimony in preparation bombarded by slow neutrons. (tr-auth)

MATHEMATICS

1976 APAE-Memo-9

Alco Products, Inc., Schenectady, N. Y.

MATRIX INVERSION OF IBM 650 — PROGRAM 40. F. B. Fairbanks. Mar. 22, 1956. 6p. Contract [AT(11-1)-318]. $1.80(ph OTS); $1.80(mf OTS).

1977 DP-172

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

IBM 650 ROUTINE. I. POLYNOMIAL FIT BY LEAST SQUARES. Richard R. Haefner. Sept. 1956. 24p. Contract AT(07-2)-1. $0.25(OTS).

A routine was prepared for the IBM-650 computer to obtain the least squares fit of a polynomial $\sum_{i=0}^{N} a_i x^i$ to a set of 100 or fewer experimental points $f_k(x_k)$. The upper limit of N is 15. (auth)

1978 KAPL-M-JA-3

Knolls Atomic Power Lab., Schenectady, N. Y.

SUPPLEMENT TO RESUME' OF TOSPY OPERATING INSTRUCTIONS (UNIVAC). Julius A. Archibald, Jr. Nov. 16, 1956. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

This report is a supplement to KAPL-M-JA-1.

Modifications of the UNIVAC for use with the TOSPY code are given. (J.H.M.)

MEASURING INSTRUMENTS AND TECHNIQUES

1979 HW-41439

Hanford Atomic Products Operation, Richland, Wash.

SURFACE DOSIMETRY AND EFFECTIVE ENERGY CALCULATIONS. G. L. Helgeson. Sept. 8, 1956. 40p. Contract W-31-109-Eng-52. $0.30(OTS).

Methods developed at Hanford for determining surface

dose rates are reviewed. The influence of source geometry, radiation effective energy, and instrument energy sensitivity on dose rate values is considered. (D.E.B.)

1980 JENER-Pub-12

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

THE SCINTILLATION COUNTER AS A DEVICE FOR ABSOLUTE MEASUREMENTS, AND FOR DETERMINATION OF NEUTRON ENERGIES. Bertel Grimeland. 1956. 91p.

Problems associated with the absolute measurement of neutron fluxes are discussed. Methods for both the activation type and the direct type of measurement are reviewed. Topics discussed include: measurements of neutron densities with Na(Tl) crystals; determination of the neutron energy spectrum by means of boron absorbers; absolute counting of γ particles; absolute measurements of beta particles by means of a plastic scintillator; direct registration of low-energy neutrons by means of scintillation counters; methods for obtaining activation cross sections; the activation cross sections of Na, Al, Ag, Fe, I, and P; fast neutron flux measurements by means of threshold reactions; and energy measurements of monoenergetic neutrons by means of a plastic scintillator. (C.H.)

1981 NP-6171

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PREPARATION OF LARGE PLASTIC SCINTILLATORS. Technical Report No. 69. George W. Clark, Frank Scherb, and William B. Smith. Sept. 15, 1956. 21p. Contract Nonr-1841(16).

Techniques are described which were used in the preparation of large plastic discs for use in scintillation detectors. The relative merits of various mixtures with polystyrene, equipment, production procedures, and the performance and utilization of plastic scintillators in radiation detectors are discussed. (C.H.)

1982 UCRL-3539

California. Univ., Berkeley. Radiation Lab.

MILLIMICROSECOND COINCIDENCE INSTRUMENTATION AND ITS LIMITATIONS. Melvin Brown. Oct. 2, 1956. Contract W-7405-eng-48. $0.10(OTS).

Present nuclear experimentation requires millimicrosecond coincidence instrumentation. The object of fast circuitry is to obtain statistically valid results, implying short resolving times with high counting rates. The limitations in obtaining these results lie not only in the electronic circuit, but also in all the associated system components, including the scintillation crystal and photomultiplier tube. A coincidence system is described herein with a discussion of its inherent limitations and methods of improving similar systems. (auth)

1983 UCRL-4712

California. Univ., Livermore. Radiation Lab.

ELECTRONICS COUNTING ROOMS FOR NUCLEAR RESEARCH. Alexander J. Stripeika. June 14, 1956. 23p. Contract W-7405-eng-48. $0.25(OTS).

This report describes six electronics areas at the Radiation Laboratory (Berkeley and Livermore) that are being successfully used with various particle accelerators for nuclear research. The electronics equipment, consisting of pulse amplifiers, scalers, coincidence circuits, pulse-height analyzers, automatic recording equipment, high-voltage supplies, etc., is arranged in such a manner that most experiments can be quickly set up, and a number of people can run experiments simultaneously. Advantages and limitations of these areas are discussed. (auth)

1984 WAPD-RD-87

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

FEASIBILITY OF THE GASEOUS FISSION PRODUCT MONITOR FOR THE MONITORING STATION IN THE PWR FUEL ELEMENT FAILURE INSTRUMENTATION SYSTEM. N. J. Palladino. Sept. 14, 1955. 2p. $1.80(ph OTS); $1.80(mf OTS).

1985

A LOW DOSE RANGE, CHEMICAL, RADIATION DETECTOR FOR PERSONNEL MONITORING. Sanford C. Sigoloff (School of Aviation Medicine, United States Air Force, Austin, Texas). Am. Ind. Hyg. Assoc. Quart. 17, 426-8 (1956) Dec.

1986

STUDY OF THE CONTRACTION FACTOR IN NUCLEAR EMULSIONS. J. Catalá and J. Casanova. Anal. real soc. espan. fis. y quim. (Madrid) Ser. A 52A, 155-72(1956) July-Aug. (In Spanish)

The variation of the shrinkage factor versus several conditions was studied experimentally. A calculation is carried out to find the theoretical value that the shrinkage factor should have, assuming that in processing, the glycerin and silver halide are completely extracted from the emulsion. In the first part, it is pointed that during the immersion loading method, a part of the glycerin is extracted, and thus the original emulsion thickness is changed. The influence both of the fixation and washing time on the shrinkage factor is studied. The changes of the shrinkage factor when the processed plate is placed into an atmosphere with a relative humidity changing between 0 to 100% are found. In the second part, the shrinkage factor versus the emulsion thickness is studied showing that it remains steady. The method involves the scanning of a plate exposed to the α particles from a radioactive element electrodeposited on a metallic disc which is placed upon the emulsion, and measuring in the processed plate, the K-factor for each track. In order to facilitate the calculations, a special abacus was used. In the third part, the first results concerning a treatment of emulsions with an alcoholic solution of colophony resin in order to recover the original thickness are shown. (auth)

1987

STUDY OF THE SCATTERING OF α TRACER IONS IN MOIST NUCLEAR EMULSIONS. Roger Desprez. Ann. phys. (13) 1, 779-807(1956) Sept.-Oct. (In French)

An experimental technique is described for studying the scattering of tracer ions in nuclear photographic emulsions. Beginning with the enumeration of α particles registered during the transitory scattering run an attempt was made to obtain the value of the diffusion coefficient by the duration of the event. Perturbing effects were accounted for by considering only the normalized distribution of the number of α tracks as a function of distance in the radioactive solution. The experimental distribution is in good agreement with that calculated from Fick's law. (tr-auth)

1988

A WINDOWLESS FLOW-TYPE GEIGER COUNTER FOR THE ASSAY OF SOLID MATERIALS CONTAINING SOFT β-EMITTING ISOTOPES. T. E. Banks, L. W. Blow, and G. E. Francis (Medical Coll. of St. Bartholomew's Hospital, London). Biochem. J. (London) 64, 408-11(1956) Nov.

A windowless Geiger counter for the assay of soft β-emitting isotopes is described. The counting gas mixture is arranged to flush air from a second sample while the first is being counted. The counter has a low background count rate and the counting efficiency is said to be three to four times that of commercial thin-window Geiger counters for

C^{14} or S^{35}. The counter also proved efficient for measuring activity from tritium. (C.H.)

1989

SOME TECHNIQUES IN THE ASSAY OF TRITIUM. T. E. Banks, J. C. Crawhall, and D. G. Smyth (Medical Coll. of St. Bartholomew's Hospital, London). Biochem. J. (London) 64, 411-16(1956) Nov.

A method of estimating tritium in infinitely thick solid samples in a windowless flow-type counter is described. It is shown that in this apparatus the observed count rates of tritium-labelled compounds are directly proportional to their specific activities, provided that the samples are rendered electrical conductors by first mixing them with graphite. The ratio between the observed count rate and the specific activity of the compound is not significantly affected by the presence of a silver atom in the molecule. Some modifications to the counting technique of White et al. (1950), in which tritium is assayed as methane gas, are described. The relative values of gas-counting and solid-counting techniques for tritium are discussed. (auth)

1990

A LARGE PERMANENT MAGNET BETA-RAY SPECTROGRAPH. Milorad S. Mladjenović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 53-68(1956) Mar.

A large permanent magnet β spectrograph is described. The pole pieces are 100 × 60 cm with the maximum path radius of 44 cm. Photographic plates or two G. M. counters can be used alternatively as detectors. (auth)

1991

FATIGUE OF PHOTOMULTIPLIERS IN SCINTILLATION COUNTERS. Mirko M. Vojinović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 93-8(1956) Mar.

The measurement of the gain stability of the scintillation counter is described. Instability due to fatigue effect of the photomultiplier is observed and results for different types of photomultipliers are given. (auth)

1992

DIRECT READING OF THE VERTICAL COMPONENT OF PARTICLE TRACKS IN NUCLEAR EMULSION. Bogdan C. Maglic. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 209-10(1956) Mar.

A mechanical device is shown which will give a direct reading of the vertical component of particle tracks in nuclear emulsion. (B.J.H.)

1993

ON A RAPID METHOD OF IDENTIFYING AND MEASURING RADIOACTIVE IMPURITIES. Yves Le Gallic. Compt. rend. 243, 1623-6(1956) Nov. 19. (In French)

A description is given of a method allowing the detection and determination of radioactive impurities, in the midst of another radioelement. Application was made to the case of P^{32} in S^{35}. (tr-auth)

1994

CHEMICAL DOSIMETRY OF THE VARIOUS RADIATIONS FROM A NUCLEAR REACTOR. Jacques Pucheault (Institut du Radium, Paris). J. chim. phys. 53, 705-13(1956) Sept. (In French)

The complex radiation emitted at the interior of a nuclear reactor has been used by various authors in order to study the action of ionizing radiations on certain oxide reduction systems. In order to facilitate such studies, the dosimetry of pile γ rays with the aid of the radiochemical reduction of ferrine was perfected as well as a method allowing the measurement of neutron fluxes and the energies of heavy ionizing particles (recoil protons) absorbed in the solutions. (tr-auth)

1995

A MICROCHEMICAL METHOD FOR THE PREPARATION OF SOURCES OF ACTINIUM AND EUROPIUM FOR β-RAY SPECTROSCOPY. S. Bjørnholm, O. B. Nielsen, and R. K. Sheline (Univ. of Copenhagen, Denmark). Nature 178, 1110-11(1956) Nov. 17.

1996

AN ELECTRONIC SCANNER FOR NUCLEAR EMULSIONS. E. Amaldi, C. Castagnoli, and C. Franzinetti (Istituto di Fisica dell'Universita-Roma and Istituto Nazionale di Fisica Nucleare-Sezione di Roma). Nuovo cimento (10) 4, 1165-73(1956) Nov.

The preliminary results obtained by means of an electronic scanner for nuclear emulsions, are given. This instrument makes it possible to count and record tracks produced by almost parallel particles such as those obtainable from an accelerator. The general principles of the method upon which a technique of electronic scanners can be developed, are discussed. A description of the main features of the apparatus is given and some preliminary results are reported. (auth)

1997

MODIFIED END-WINDOW COUNTING TUBE FOR PAPER CHROMATOGRAMS. R. C. Fuller (Brookhaven National Labs., Upton New York). Science 124, 1253(1956) Dec. 21.

1998

ON THE PAPER BY N. I. STEINBOK "BASIC CHARACTERISTICS OF IONIZATION CHAMBERS." K. K. Aglintsev. Soviet Phys. JETP 3, 458-9(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 429(1956) Feb. (In Russian)

The variation in intensity of the electrical field between the anode and the cathode in a flat air-type ionization chamber was examined, and the volt-ampere characteristics were evaluated on the basis of the supposition that in weak ionization the space charge may be ignored. (F.S.)

MESONS

1999

CONCERNING THE NUMBER OF DIFFERENT TYPES OF K-MESONS. B. Ioffe, L. Okun, and I. Pomeranchuk (U.S.S.R. Academy of Sciences, Moscow). Nuclear Phys. 2, 277-80(1956) Nov.

The small angle scattering cross sections of K mesons by deuterons with and without charge exchange are estimated and their bearing on the question of the number of different types of K mesons discussed. Possible interpretations are examined for the difference of K meson scattering by free and bound nucleons. (auth)

2000

NOTE ON THE NUMBER OF DIFFERENT TYPES OF K-MESONS. I. Pomeranchuk (U.S.S.R. Academy of Sciences, Moscow). Nuclear Phys. 2, 281-2(1956) Nov.

2001

BURST PRODUCTION BY SPIN-3/2 PARTICLES. A. N. Mitra (Muslim Univ., Aligarh). Nuclear Phys. 2, 283-5 (1956) Nov.

A brief discussion is given on the possibility of predicting the spin of the muon on the basis of burst production by these particles. The fluctuation in the number of burst particles is also considered. (B.J.H.)

2002

ANALYTICAL SOLUTION OF THE COVARIANT MESON NUCLEON INTEGRAL EQUATION. I. E. McCarthy (Cavendish Lab., Cambridge, England). Nuovo cimento (10) 4, 991-1008(1956) Nov.

The covariant integral equation for meson scattering in the $T = {}^3/_2$ state is investigated by the Fredholm method. Assuming that the zeros of the Fredholm denominator give resonances in the scattering cross-sections, the known resonance is accounted for using $G^2/4\pi = 14.1$. The experimental cross-sections are fitted reasonably well when radiative

corrections are accounted for by a numerical factor in the low energy approximation, and discrepancies are accounted for qualitatively. (auth)

2003

REMARKS ON THE ANALYSIS OF τ MESON EXPERIMENTS. N. Brene, K. H. Hansen, J. E. Hooper and M. Scharff (Inst. for Theoretical Physics, Univ. of Copenhagen, Denmark). Nuovo cimento (10) 4, 1059-85(1956) Nov.

The results from the analysis of 75 stopped τ-meson decays, found in a stack of emulsions exposed to the Berkeley Bevatron, are discussed. Special attention is paid to the effects of the finite dimensions of the stack, and a brief analysis of the problem is given. The experimental results are compared with those from other laboratories, and the authors conclude that there is no good evidence that the spectrum of the π mesons from τ decay is in accord with either of those which have been predicted for the two lowest spin-parity combinations: 0^- and 1^+. (auth)

2004

ON THE MEAN LIFE TIME OF K-MESONS PRODUCED BY THE COSMIC RADIATION. L. Mezzetti and J. W. Keuffel (Palmer Physical Lab., Princeton Univ., N. J.). Nuovo cimento (10) 4, 1098-1126(1956) Nov.

An experiment performed at Echo Lake (Colorado) in order to measure the mean lifetime of charged heavy mesons produced by the cosmic radiation is described. The delay distributions obtained can be resolved into a short life component (lifetime $(9.6 \pm 0.8 \times 10^{-9})$ s) and a long life component (lifetime (2.2 ± 0.2) μs); the latter is interpreted as due to the electrons of the composite $\pi \to \mu \to e$ decay of π^+-mesons produced locally by the incident nucleons. The possibility that the short life component is due to spurious effects of some kind is discussed and ruled out on the basis of the results of auxiliary measurements: the conclusion is that the lifetime obtained should be associated essentially with the $K_{\mu 3}$ decay mode, with a possible small admixture of $K_{\pi}(\theta^+)$. A rough estimate of the production ratio of such particles to positive π-mesons is made, taking into account the corresponding detection efficiencies; the value found is rather higher than those (1:30–1:70) obtained from previous cosmic ray experiments. The lifetime obtained is compared with the recent results of others and the assumptions of a purely exponential decay curve with an unique lifetime is discussed. (auth)

2005

ADDENDUM TO «K-MESONS IN EMULSIONS EXPOSED TO A 6.2 Gev PROTON BEAM». J. Crussard, V. Fouche, J. Hennessy, G. Kayas, L. Leprince-Ringuet, D. Morellet and F. Renard (Laboratoire de Physique de l'Ecole Polytechnique–Paris). Nuovo cimento (10) 4, 1195-7(1956) Nov.

Tables of measurements of K mesons in emulsions exposed to a 6.2-Bev proton beam are presented. (T.R.H.)

2006

THE ANGULAR DISTRIBUTIONS IN THE HYPERON DECAYS–II. G. Morpurgo (Scuola di Perfezionamento in Fisica Nuclear, Istituto di Fisica dell'Universita–Roma). Nuovo cimento (10) 4, 1222-6(1956) Nov.

Expressions of the angular distributions in the hyperon decays previously derived under the assumption of parity conservation are re-examined. The assumption of nonconservation of parity produces assymetries in some of the angular distributions. These assymetries are examined both for parity nonconservation and for the parity doublet model. (T.R.H.)

2007

PION-NUCLEON COUPLING CONSTANT AND SCATTERING PHASE SHIFTS. Uri Haber-Schaim (Univ. of Illinois, Urbana). Phys. Rev. 104, 1113-15(1956) Nov. 15.

Goldberger's relations for the forward scattering of pions are used in the following way. Two linear functions of ν^2, where ν is the total pion energy in the laboratory system, are constructed from quantities taken from experiment, i.e., forward amplitudes and integrals over total cross sections. The extrapolation of one of these functions to $\nu = 0$ gives $2f^2$, where f is the renormalized pion-nucleon coupling constant. Various sets of phase shifts are compared as to their compatibility with the above functions. (auth)

2008

DISPERSION RELATIONS FOR FIXED-SOURCE MESON THEORIES: EFFECTIVE-RANGE RELATIONS. Abraham Klein (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 104, 1136–41(1956) Nov. 15.

2009

DISPERSION RELATIONS FOR FIXED-SOURCE MESON THEORIES. Abraham Klein (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 104, 1131–6(1956) Nov. 15.

Dispersion relations for a class of Hamiltonian operators describing meson theories with a fixed, extended source are derived for meson-nucleon scattering. It is assumed that each meson field operator is coupled to its own source, and a restriction is imposed on the maximum number of temporal or spatial derivatives of the field operator that can occur in any one term. On the other hand, the interaction need not be linear in the meson field. With these assumptions, nonrelativistic versions of all proposed relativistic dispersion relations are derived rigorously. In particular, the P-wave equations of Chew and Low are obtained, as well as a set of equations for the S waves. (auth)

2010

MESON PRODUCTION BY MESONS IN THE TAMM-DANCOFF APPROXIMATION. Mark Nelkin (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 104, 1150-64(1956) Nov. 15.

The cross section for the production of a single additional meson in meson-nucleon collisions is calculated. The charge-symmetric pseudoscalar interaction is used in the Tamm-Dancoff approximation, neglecting the amplitudes of all states containing more than two mesons. The results are presented by giving the ratio of production to scattering cross section as a function of the energy, angular momentum, parity, and isotopic spin of the incident state. This ratio can be obtained either by direct calculation of the production matrix element, or by calculation of the reactive effects on meson-nucleon scattering. It is explicitly shown that these two methods give identical results in the physical approximation employed. An estimate is made of the production cross section very near threshold, and numerical results are presented for incident meson energies up to 1.4 Bev. The experimental information that is available indicates that the ratio of production to scattering is considerably greater than has been calculated here. This discrepancy is probably due to the omission of final state scattering through three-meson intermediate states. (auth)

2011

DYNAMICAL THEORY OF K MESONS. Julian Schwinger (Harvard Univ., Cambridge, Mass.). Phys. Rev. 104, 1164-72(1956) Nov. 15.

Considerations leading to a complete dynamical theory of K particles and hyperons are outlined. The theory exploits several points of analogy between the π field and the electromagnetic field, and gives a qualitatively satisfactory description of a number of phenomena. In particular, it accounts for the variety of K-particle decay modes, including those exhibiting opposite parity. (auth)

2012

MESON REACTIONS IN TWO-NUCLEON SYSTEM. Shigeo

Minami (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 15, 12-18(1956) Jan.

With the charge independence hypothesis, the meson-nucleon interaction in a two-nucleon system is studied by analyzing the data of meson production in nucleon–nucleon collision and of meson–deuteron reaction. (auth)

2013

NOTE ON THE DECAY INTERACTIONS OF HYPERONS AND HEAVY MESONS. Masaaki Kawaguchi and Kazuhiko Nishijima (Kyoto Univ., and Osaka City Univ.). Progr. Theoret. Phys. (Japan) 15, 180-2(1956) Feb.

2014

NOTE ON THE DECAYS OF Σ PARTICLES. Masaaki Kawaguchi and Kazuhiko Nishijima (Kyoto Univ., and Osaka City Univ.). Progr. Theoret. Phys. (Japan) 15, 182-3 (1956) Feb.

2015

ASYMPTOTIC MESON-MESON SCATTERING THEORY. I. T. Diatlov and K. A. Ter-Martirosian (Leningrad Phisico-Technical Inst.). Soviet Phys. JETP 3, 454-6(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 416-19(1956) Feb. (In Russian)

An integral equation was constructed to determine the meson-meson scattering amplitude using only the contribution of the simplest entering meson line. (F.S.)

2016

PION-PROTON INTERACTIONS AT 1.4 BEV. A. I. Nikishov. Soviet Phys. JETP 3, 634-6(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 601-3(1956) Mar. (In Russian)

Pion-proton interactions at 1.4 Bev were studied using the Fermi statistical theory allowing for the formation of isobar states and were found to agree with experiments. The results were compared with statistical calculations which neglect isobars. (F.S.)

MOLECULAR PROPERTIES

2017

MAGNETIC STRUCTURES OF THE POLYMORPHIC FORMS OF MANGANOUS SULFIDE. Lester Corliss, Norman Elliott, and Julius Hastings (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 924-28(1956) Nov. 15.

Manganous sulfide exists in three polymorphic forms. There are two cubic modifications, α-MnS having the rock salt structure and β-MnS with the zinc blende structure. The third form is hexagonal β-MnS with the wurtzite structure. The magnetic susceptibilities of all three forms and the antiferromagnetic-structures, as determined by neutron diffraction, are reported. α-MnS exhibits ordering of the second kind, in agreement with earlier work. The spin direction, however, is found to be in the ferromagnetic (111) sheets rather than along cube edges. In the cubic β-MnS case, the magnetic structure is the hitherto unobserved "improved ordering of the first kind" proposed by Anderson. The spin direction is normal to the unique cubic axis. The hexagonal β-MnS antiferromagnetic structure can be derived from the cubic β-MnS by stacking the close-packed (111) sheets of the zinc blende form according to the scheme ABA–appropriate to hexagonal close-packing. The magnetic unit cell is orthohexagonal with $a_0' = a_0\sqrt{3}$, $b_0' = 2a_0$, $c_0' = c_0$, where the unprimed symbols refer to the original hexagonal cell. The spin direction is normal to the (011) plane. These magnetic structures are discussed on the basis of an indirect exchange coupling mechanism. (auth)

NEUTRONS

2018 KAPL-M-RTF-6

Knolls Atomic Power Lab., Schenectady, N. Y.

CORRECTION OF MEASURED NEUTRON ENERGY SPECTRA FOR FINITE RESOLUTION EFFECTS. R. T. Frost. Dec. 3, 1956. 4p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The measurements of the neutron energy spectra measured with the neutron chopper time-of-flight experiment were considered. The measured energy distributions were corrected for the effect of the finite resolution with which the time-of-flight was measured. Contributions to this finite resolution arise from the non-zero burst width, the finite, size of the detector and the counter "jitter." (F.S.)

2019 NYO-6270

Nuclear Development Corp. of America, White Plains, N. Y.

A SOLUTION OF THE NEUTRON TRANSPORT EQUATION. PART III. RECONSTRUCTION OF A FUNCTION FROM ITS MOMENTS. J. Certaine. July 31, 1956. 59p. Contract AT(30-1)-862. (NDA-15C-61) $0.40(OTS).

Methods are given which have been found useful in the reconstruction of the components of the expansion of the angular flux in a Legendre polynomial expansion in a study of a solution of the neutron transport equation. (F.S.)

2020

DETERMINATION OF SOURCE INTENSITY OF A Be-PHOTO AND A Ra–Be NEUTRON SOURCE. C. von Planta and P. Huber. Helv. Phys. Acta 29, 375-400(1956) Oct. (In German)

2021

THE ENERGY OF DELAYED NEUTRONS FROM FISSION. R. Batchelor and H. R. McK. Hyder (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 3, 7-17(1956) Aug.

The energy spectra of the delayed neutrons from thermal fission of U^{235} have been measured with a He^3 fast-neutron spectrometer. A pneumatic rabbit was used to eject an irradiated sample of U from the reflector of B.E.P.O to a position outside the pile near the spectrometer, which then counted the delayed neutrons emitted during a known time-interval. By varying the irradiation and counting times, the four longest periods were accentuated in turn. The neutron energy spectrum associated with each period has been inferred from our measured pulse-height distribution, using the published data on half-lives and relative intensities. Mean energies have been calculated for the four periods studied, and a theoretical argument is advanced to account qualitatively for the spectral shapes obtained. (auth)

2022

SCATTERING OF 4.4-Mev NEUTRONS BY ALUMINUM, CALCIUM, CHROMIUM, AND BISMUTH. J. B. Weddell (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 104, 1069-72(1956) Nov. 15.

The spectra of neutrons scattered by Al, Cr, Ca, and Bi for an incident neutron energy of 4.4 Mev have been measured by the proton-recoil nuclear plate technique. The energies of the levels excited by the (n,n'γ) process, given here, are obtained from previous measurements of the de-excitation gamma-ray energies while the cross sections are based on the nuclear plate results alone. The results are: Al, scattering angle 82°: elastic, 46 ± 10 mb per sterad; unresolved inelastic levels at 0.84 and 1.01 Mev, 19 ± 7 mb per sterad; 2.23-Mev level, 15 ± 5 mb per sterad; 3.0-Mev level, 10 ± 5 mb per sterad; Ca at 82°: elastic, 49 ± 12 mb per sterad; inelastic — none; Cr at 90°: elastic, 37 ± 7 mb per sterad; 1.45-Mev level, 14 ± 5 mb per sterad; 2.43-Mev level (partially resolved), 5.0 ± 2.5 mb per sterad; 3.13-Mev level (partially resolved), 14 ± 7 mb per sterad; Bi at 82°: elastic, 185 ± 40 mb per sterad; unresolved spectrum in energy range 0.9 Mev to 2.5 Mev, 135 ± 45 mb per sterad. (auth)

2023

ANTINEUTRONS PRODUCED FROM ANTIPROTONS IN

CHARGE-EXCHANGE COLLISIONS. Bruce Cork, Glen R. Lambertson, Oreste Piccioni, and William A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 104, 1193-7 (1956) Nov. 15.

2024

CONCERNING THE INTERACTION CROSS SECTIONS OF NEUTRONS WITH NUCLEI. P. E. Nemirovskii. Soviet Phys. JETP 3, 484-91(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 551-9(1956) Mar. (In Russian)

A new quasi-classical solution of the Schrödinger equation for $E > |V|$ is proposed. This approximation is applied to the solution of the problem of the motion of a neutron in a potential with a complex component. An explanation is obtained for the behavior of total cross sections in the energy region 20 to 100 Mev. For energies of 2 to 10 Mev the Schrödinger equation is solved for a complex potential which goes to zero exponentially at infinity. It is shown that the absorption cross section for a well with fuzzy edges does not have sharp maxima as a function of R and E. This is in contrast to the results for the absorption cross sections for a rectangular potential well. The agreement of the calculated absorption cross sections at 2.5 and 4.3 Mev with experimental values is satisfactory. (auth)

2025

CONCERNING THE ELECTRIC CHARGE OF THE NEUTRON. I. S. Shapiro and I. V. Estulin (Moscow State Univ.). Soviet Phys. JETP 3, 626-8(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 579-80(1956) Mar. (In Russian)

In an experiment leading to a small value of the upper bound of the neutron charge an attempt to observe the deflection of a narrow beam of neutrons in an electric field is reported but no deflection of the atomic beam under the influence of the electric field was observed. (F.S.)

NUCLEAR PHYSICS

2026 ANL-5609

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] APRIL THROUGH AUGUST 1956. Nov. 1956. 127p. Contract W-31-109-eng-38. $0.60(OTS).

The second rotor for the Argonne fast neutron velocity selector was designed and construction was begun. The thick-sample method used to obtain the energy dependence of η for Pu^{239} was extended to higher energies. The results are shown in graphical form. The operation of the Van de Graaff accelerator during the period is summarized. The properties of the 585-kev neutron scattering resonance in S^{32} were studied, and the experimental results are shown. A schematic diagram is shown of equipment to be used in measuring excitation energies of residual nuclei in (p,n) and similar reactions. As a test of the technique, a study was made of the $Mn^{55}(p,n)Fe^{55}$ reaction. The resulting energy level diagram for Fe^{55} is given. The decay properties of Sn^{123} are also briefly discussed. An extensive study was made of the decay properties of Mo^{101} and Tc^{101}, and decay schemes for both isotopes are shown. A decay scheme is also shown for Yb^{177}. The gamma rays observed in the decay of Sn^{125} are listed, and its decay scheme as deduced from these data is given. A study is being made of the γ rays from fission of U^{235} induced by thermal neutrons. The energy of delayed neutrons from fission is discussed. The study of the spectrum of γ rays from Au using the 7.7-meter bent crystal spectrometer was continued. Atomic-beam magnetic-resonance experiments were carried out using In^{113m}. Total cross sections for 14-Mev neutrons are reported for Cd, Pd, Nd, Sm, Hf, and Ta. Experiments are proposed for the measurement of neutron half life using a diffusion cloud chamber. A study was made of the atomic excitation following β decay of T, and the resultant data are tabulated. Relative scintillation light outputs from toluene solutions with β particle excitation are tabulated. Additional information was obtained on the effectiveness of various "intermediate solvents" in reducing the quenching of scintillation light output resulting from the presence of diphenyl mercury in toluene scintillation solutions. Data are also shown on the oxygen quenching of toluene scintillator solutions. Results obtained with plastic scintillators are shown graphically. An investigation was made of the effect on the light output when diphenylmercury was added to these plastic scintillators. The effects of polymerization temperature on the light output of the plastic scintillator were also studied. Data previously obtained on electrical conduction in dielectrics were organized and analyzed. Studies of the spectrum of masses associated with the positive-ion bombardment of Be were continued. The effect of inelastic scattering in the analysis of scattering resonances is discussed. (For preceding period see ANL-5554.) (B.J.H.)

2027 PR-P-31

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] JULY 1, 1956 TO SEPTEMBER 30, 1956. 88p. (AECL-365).

Studies of mechanisms for the genesis of nuclides in stars were continued. A formula was developed which is expected to add to the knowledge of abundance changes resulting from neutron capture on a slow time scale. Neutron production and capture processes are discussed. The study of Tb^{160} decay was continued. The conversion lines identified and their relative intensities are listed. Conversion coefficients for Np^{239} gammas were measured, and compared with the calculated values of Rose and Sliv. K-LL Auger intensities for Z = 94 are tabulated. Three annihilation times were measured for positrons in liquid He; 1.8-, 2/7-, and 85×10^{-9} sec. The intensities of the τ_2 component of positron annihilation in three qualities of quartz are reported and discussed. The characteristics of He^3 reactions with C^{12}, C^{13}, B^{10}, and Be^9 are reviewed. A plot of cosmic-ray burst data yields a slope of -2.50 between 66 and 760 Mev and -3.03 between 760 and 30,000 Mev for electrons and photons combined. Neutron scattering patterns of paramagnetic MnO and liquid A were analyzed. The methods of analysis and the results are discussed. Gamma ray intensities and energies from the decay of 2.3-d Np^{239} were measured with a curved-crystal spectrometer. Ten gammas in the energy range 61.6 to 333.5 kev are reported. The status of detection and counting equipment development programs is reviewed. Studies of reactor power flattening by enrichment were continued on a three-region, bare-end, cylindrical core of 2.7-m length and 1.35-m radius. A constant power density to 97.5 cm and a total power multiplication of 2.5 is indicated by an enrichment of 17.5 kgm of U^{235}. A study of the oscillator model of the nucleus indicates this model will provide an understanding of the collective aspects of nuclear motion. NRU control rod mechanism test and temperature control design are reported. (For preceding period see PR-P-30.) (D.E.B.)

2028

REVERSIBILITY AND IRREVERSIBILITY IN NUCLEAR RESONANCE. Joseph Seiden. Compt. rend. 243, 1201-3 (1956) Oct. 22. (In French)

2029

REVERSIBILITY AND IRREVERSIBILITY IN NUCLEAR RESONANCE. Joseph Seiden. Compt. rend. 243, 1308-10 (1956) Oct. 29. (In French)

2030

NON-LINEAR MESON FIELD OF A NUCLEON AT REST. A. Borgardt (Dnepropetrovsk State Univ.). Doklady Akad. Nauk S.S.S.R. 109, 1107-8(1956) Aug. 21. (In Russian)

Investigations were made of some possible types of non-linear equations of meson field with self-action in the third order. (R.V.J.)

2031

ON TEMPERATURE "OUTBURSTS" IN A MEDIUM SUBJECTED TO THE ACTION OF NUCLEAR EMISSION. I. M. Lifshits (Physico-Technical Inst. USSR Acad. of Science). Doklady Akad. Nauk S.S.S.R. 109, 1109-11(1956) Aug. 21. (In Russian)

Calculations were made to resolve mathematically the problem of "the occasional" instant sources of heat in the vicinity of nuclear division, in any arbitrary point of a body with a limited surface subjected to irradiation. (R.V.J.)

2032

PSEUDOSCALAR INTERACTIONS IN NON-LINEAR MESON DYNAMICS. A. Borgardt (Dnepropetrovsk State Univ.). Doklady Akad. Nauk S.S.S.R. 110, 42-3(1956) Sept. 1. (In Russian)

2033

DIAMAGNETIC RESONANCE IN STRONGLY MAGNETIC BODIES. Ya. G. Dorfman. Doklady Akad. Nauk S.S.S.R. 110, 201-2(1956) Sept. 11. (In Russian)

Resonance absorption in the frequency range of 10^{12} to 10^{13} can be observed at normal temperatures when the time between the conductor collisions is $\tau \geq 1/\nu_0$. This can be applied to the strongly magnetic semiconductors (ferrites, manganites, etc.) and to the materials with non-compensated antiferromagnetism. (R.V.J.)

2034

REVIEW STUDY OF THE NUCLEON-NUCLEON INTERACTION ON A SIMPLIFIED ELECTRODYNAMIC MODEL OF THE NUCLEON. J. Charon (Commissariatt à l'Énergie Atomique, Saclay). J. phys. radium 17, 887-92(1956) Oct. (In French)

2035

PION THEORY OF NUCLEAR FORCES AND n-p POLARIZATION. J. Iwadare, S. Otsuki, R. Tamagaki and W. Watari (Research Inst. for Fundamental Physics, Kyoto Univ., Japan; Department of Physics, Kyoto Univ., Japan and Department of Physics, Hiroshima Univ., Japan). Nuovo cimento (10) 4, 1204-6(1956) Nov.

It is pointed out that experiments with n-p polarization at energies below 100 Mev may contribute information on the pion theory of nuclear forces. (T.R.H.)

2036

ISOTOPIC SPIN SELECTION RULES. VIII. CHARGE INDEPENDENCE AND THE COMPARISON OF ISOBARIC TRIPLETS. D. H. Wilkinson (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 1031-42(1956) Nov.

The experimentally-determined positions of the first T = 1 states of self-conjugate nuclei up to Ca^{40} are compared with their positions calculated from the known ground state mass differences of the $T_z = +1$ and $T_z = 0$ isobars. The Coulomb correction is made in a completely automatic manner that does not involve an assumed nuclear radius but uses the experimental energy difference in the corresponding mirror pair. Close correspondence between calculated and experimental positions is found, the former being on the average higher by 35 kev. If this difference is taken to reflect a departure from equality of the n–n and n–p singlet forces the latter is stronger by about 1% (square well). This is to be compared with the difference of 3% (square well) in the same sense found between p–p and n–p and n–n singlet forces from the zero energy scattering lengths. (auth)

2037

THE NUCLEAR SURFACE. T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 1043-54(1956) Nov.

The basic ideas of Brueckner's self-consistent nuclear model are applied in a simplified, approximate form to the case of a finite nucleus. It is shown that it is possible to reconcile the observed values of surface energy and surface thickness, to explain the greater extension of the nuclear potential compared with the charge distribution, and also to fit the well-depth of the optical model for nucleon scattering. (auth)

2038

THE NUCLEAR SPIN-ORBIT COUPLING. J. S. Bell and T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 1055-68(1956) Nov.

Analysis of nucleon–nucleon scattering around 100 Mev has determined the spin-orbit coupling part of the two-body scattering matrix at that energy, and a reasonable extrapolation to lower energies is possible. This scattering amplitude has been used, in the spirit of Brueckner's nuclear model, to estimate the resultant single-body spin-orbit coupling for a single nucleon interacting with a large nucleus. This resultant potential has a radial dependence approximately proportional to $r^{-1}d\rho/dr$, and with a magnitude in good agreement with that required to explain the doublet splittings in nuclei and the polarization of nucleons scattered elastically off nuclei. (auth)

2039

NUCLEON TRANSFER AND VIRTUAL COULOMB EXCITATION. G. Breit and M. E. Ebel (Yale Univ., New Haven, Conn.). Phys. Rev. 104, 1030-46(1956) Nov. 15.

A semiquantitative explanation of the experiments of Reynolds and Zucker on transfer reactions arising in the collision of N^{14} with N^{14} is arrived at, making use of the effect of Coulomb excitation to virtual levels. These excitations are shown to be important even though a permanent separation of nuclei in Coulomb excited states may be energetically impossible. The process is of sufficient generality to have application to other similar reactions. An analysis of the experimental material shows that the process is probably important in the case of the $N^{14} + N^{14}$ reactions for all energies below that required for contact between nuclear surfaces and that it is probably the only important process at bombarding energies below 15 Mev. (auth)

2040

SPIN-ORBIT INTERACTION IN NUCLEI. L. S. Kisslinger (Western Reserve Univ., Cleveland, Ohio). Phys. Rev. 104, 1077-85(1956) Nov. 15.

The spin-orbit interaction in nuclei is derived in terms of the two-body interaction between nuclear particles. A second order Born approximation with the tensor force gives an interaction of the right order of magnitude, but apparently somewhat too small. A more general approach using the two-body reaction matrix seems to predict the Ca^{41} and O^{17} level splittings. The Thomas interaction is seen to be small. The mixed density function for the nucleus is computed to evaluate the matrix elements. (auth)

2041

BOUNDARY VALUE TREATMENT OF NUCLEON-NUCLEON PHASE SHIFTS. A. M. Saperstein and Loyal Durand III (Yale Univ., New Haven, Conn.). Phys. Rev. 104, 1102-13(1956) Nov. 15.

The recent phase-shift fits of Feshbach and Lomon to the nucleon-nucleon scattering data in the energy range $0 \leq E \leq 274$ Mev are examined in detail. An attempt is made to improve the agreement with experiment, and the limitations of the Feshbach-Lomon fits are brought out. It is not found

possible to obtain agreement with the data at all energies, even if all previously omitted phase shifts for $L \leq 3$ are included. An independent fit to the proton-proton data is then developed by a boundary value method similar to that used by Breit and Bouricius, and a set of phase shifts for $L \leq 4$ is found which fits the proton-proton cross section and polarization throughout the energy range $0 \leq E \leq 310$ Mev. There seems to be no major obstacle to using the proposed p-p fit as the basis for a charge-independent fit to all the nucleon-nucleon scattering data. (auth)

2042

COMPARISON OF SPIN-FLIP DISPERSION RELATIONS WITH PION-NUCLEON SCATTERING DATA. W. C. Davidson (Argonne National Lab., Lemount, Ill.). and M. L. Goldberger (Univ. of Chicago). Phys. Rev. 104, 1119-21 (1956) Nov. 15.

The dispersion relations for the spin-flip, forward-scattering amplitude have been tested against pion-nucleon scattering data for energies up to 300 Mev. The Fermi set of phase shifts satisfy these relations while the Yang set do not. An approximate value for the renormalized coupling constant, $f^2 = (g\mu/2M)^2$, of 0.1 is obtained from the P-wave phase shifts. (auth)

2043

VALIDITY OF THE INTERMEDIATE-COUPLING APPROXIMATION. R. Stroffolini (Istituto Nazionale di Fisica Nucleare, Sezione di Torino, Italy). Phys. Rev. 104, 1146-9(1956) Nov. 15.

The internal consistency of the intermediate coupling approximation, applied by Friedman, Lee, and Christian to the meson theory, is discussed critically. It is shown: (a) that the description of low-energy mesons in the cloud is quite unreliable; (b) that the approximation becomes more adequate for high energies; (c) that the structure of the nucleon as described by intermediate coupling does not give directly any sensible result about scattering; and (d) that the agreement found by Friedman, Lee, and Christian between theoretical results and experimental phase shifts follows essentially from the presence of the zero- and one-meson states in the scattering trial function and is not a consequence of any particular choice for the physical nucleon state. (auth)

2044

MAGNETIC MOMENT OF THE PROTON IN BOHR MAGNETONS. Peter Franken and Sidney Liebes, Jr. (Stanford Univ., Calif.). Phys. Rev. 104, 1197-8(1956) Nov. 15.

2045

ANGULAR DISTRIBUTION OF NUCLEAR REACTION PRODUCTS. G. R. Satchler (Clarendon Lab., Oxford, England). Phys. Rev. 104, 1198-1200(1956) Nov. 15.

In Phys. Rev. 94, 1304 the continuum theory of nuclear reactions was applied to predict the angular distribution of γ rays following inelastic neutron scattering. The formulas used contained an error and a numerical misprint which are here corrected. (D.E.B.)

2046

ON THE EXCHANGE MAGNETIC MOMENT OF THE TWO NUCLEON SYSTEM. Shigeki Hatano and Tadashi Kaneno (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 63-71 (1956) Jan.

The two body exchange magnetic moment operators are calculated in the pseudoscalar meson theory with non-relativistic pseudovector coupling. The method of canonical transformation is used and results are obtained to the order of eg^4 in the power series expansion. The radial parts of all possible operators in the static approximation are given. The contributions of the exchange moment to the magnetic moment of the deuteron are calculated and it is found that in order to adjust the experimental moment $\mu r = 0.74$ should be taken as the lower limit in the radial integral. (auth)

2047

RELATION BETWEEN THE QUADRUPOLE MOMENTS AND THE WIDTHS OF THE GIANT RESONANCE OF PHOTONUCLEAR REACTION. Kazuto Okamoto (Tokyo Univ.). Progr. Theoret. Phys. (Japan) 15, 75-7(1956) Jan.

2048

NATURE OF NUCLEAR FORCE INDICATED BY THE PHOTODISINTEGRATION OF THE DEUTERON, I. Shih-Hui Hsieh and Masami Nakagawa (Nagoya Univ.). Progr. Theoret. Phys. (Japan) 15, 79-81(1956) Jan.

2049

DETERMINATION OF THE PION COUPLING CONSTANT IN NUCLEAR FORCES. Junji Iwadare, Shoichiro Otsuki, Ryozo Tamagki and Wataro Watri (Kyoto Univ., and Hiroshima Univ.). Progr. Theoret. Phys. (Japan) 15, 86-8 (1956) Jan.

2050

PION THEORY OF NUCLEAR FORCES. Kazuhiko Inoue, Shigeru Machida, Mitsuo Taketani and Toshiyuki Toyoda (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Japan) 15, 122-36(1956) Feb.

Recently a general and formal method to construct nuclear potentials has been proposed by Fukuda, Sawada, and Taketani. Applying the method to the pion theory and adopting fixed and extended sources, nuclear potentials were evaluated. The result seems to be in favor of that of Taketani, Machida, and Onuma rather than that of Brueckner and Watson. As a cut-off function, a Gaussian error function with $k_{max} = 6\mu c$ was assumed. In the case of the effective coupling constant $g^2/4\pi = 0.08$ it is found that the effect of the extended source becomes very strong in the region for $r < 0.7\ \hbar/\mu c$. If these potentials are used for $r > 0.7\ \hbar/\mu c$ and phenomenological potentials inside this range, satisfactory results may be obtained to explain the properties of the two nucleon system in the low energy region. (auth)

2051

INTERMEDIATE COUPLING MESON THEORY OF NUCLEAR FORCES, II. Yukihisa Nogami and Hiroichi Hasegawa (Univ. of Osaka Prefecture, Sakai, and Osaka City Univ.). Progr. Theoret. Phys. (Japan) 15, 137-50 (1956) Feb.

A method has been proposed to construct the nuclear potential by means of the intermediate coupling theory, where the charged scalar theory has been taken as an example. This method is applied to a realistic case, symmetrical pseudo-scalar theory with pseudo-vector coupling, and the static nuclear potential is obtained up to the order of e^{-2x}, where $x = \mu r$. The results are found to depend on the cut-off procedure which is inevitably introduced to avoid divergence. A cut-off factor should be chosen so that effects of the so-called contact interaction do not extend onto the exterior region $x \gtrsim 1.0$. A cut-off factor of gaussian type is taken as suitable. This potential does not essentially differ from the FST-potential and the BW-potential with cut-off. After the renormalization of the coupling constant, the potential of the order of e^{-x} coincides with the conventional second order perturbation potential in the exterior region, irrespectively of an assumed "structure" of the clothed nucleon. The potential of the order of e^{-2x}, however, depends essentially on the cut-off factor. (auth)

2052

ON A REGULAR FORMULATION OF QUANTUM FIELD THEORY, I. Ken-iti Goto (Osaka Univ.). Progr. Theoret. Phys. (Japan) 15, 167-77(1956) Feb.

A method of regular formulation of non relativistic quantum field theory is presented, using the well defined regular quantities and the rigorous analysis only. (auth)

2053

INTERACTION OF ANTINUCLEONS IN MATTER, I. Junji Iwadare and Shigeaki Hatano (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 185-7(1956) Feb.

The characteristics of antinucleon annihilation are considered. (D.E.B.)

2054

DEVELOPMENTS IN HIGH-ENERGY PARTICLE PHYSICS. L. I. Lapidus. Vestnik Akad. Nauk S.S.S.R. 26, No. 8, 97-106(1956) Aug. (In Russian)

A review is given of the discussions and reports presented at the National Conference of Physico-Mathematical Sciences in Moscow, May 14 to 22, 1956. (R.V.J.)

2055

ON ALPHA-DECAY THEORY FOR NONSPHERICAL NUCLEI. V. M. Strutinskii. Soviet Phys. JETP 3, 450-1(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 411-12 (1956) Feb. (In Russian)

The probability of excitation of the rotational states of a nucleus during α-decay of heavy nonspherical nuclei was previously calculated with the rotation of the nucleus assumed to be slow compared to the motion of the α-particle (adiabatic approximation). The question whether this approximation is applicable was not really considered. In the case of even-even nuclei, where the moment of the total system is zero, a theory which is not based on the adiabatic approximation was developed. (auth)

2056

NUCLEAR SHELLS AND THE CLASSIFICATION OF ATOMIC NUCLEI. A. V. Savich. Soviet Phys. JETP 3, 400-9 (1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 501-10(1956) Mar. (In Russian)

A nuclear shell model is proposed, on the basis of which classification is carried out of the spins and magnetic moments of the ground and metastable levels of nuclei with odd mass number. Classification is also made of the masses and of data on β decay of nuclei with odd mass number. (auth)

2057

CONTRIBUTION TO THE THEORY OF PRODUCTION AND ANNIHILATION OF ANTIPROTONS. L. M. Afrikian (P. N. Lebedev Physical Inst., U.S.S.R. and Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 503-11(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 734-45(1956) Apr. (In Russian)

The processes leading to production of antiprotons by π mesons on nucleons are considered in the framework of charge-independent pseudoscalar meson theory. The cross sections for these processes are calculated near the threshold. It is shown that the interaction between the particles in the final state may lead to a capture of the antiproton produced by a nucleon into a deuteron-like orbit. This last fact may make it difficult to detect antiprotons near the threshold because of the high capture probability, and the short life ($\tau \approx 10^{-21}$ sec) of the antiproton in the bound state with respect to annihilation. Processes leading to antiproton production in nucleon-nucleon collisions are also considered. The cross sections for these processes are calculated near the threshold, taking into account the interaction between the created particles. (auth)

NUCLEAR PROPERTIES

2058 NRDC-54

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FAST NEUTRON CAPTURE CROSS-SECTION OF Nb: A STATEMENT OF THE PROBLEM. P. E. Cavanagh. Oct. 26, 1954. 3p.

2059

LEVEL SCHEME OF Cs^{131}. Hamlet Vartapetian. Compt. rend. 243, 1512-14(1956) Nov. 12. (In French)

Proof is given of coincidences between the 915- and 122-kev radiations and the 820- and 214-kev radiations, and the existence of the 245-kev photon, in coincidence with that of 370 kev, is shown. By a method which uses the L/K capture ratio, a determination was made of the α_K conversion coefficient of the 122-kev photon; $\alpha_K = 0.39 \pm 0.04$. It is compatible with that of pure M1 radiation. (tr-auth)

2060

EFFECT OF IMPURITY OF QUADRUPOLE RESONANCE. Bernard Dreyfus and Daniel Deutreppe. Compt. rend. 243, 1517-20(1956) Nov. 12. (In French)

An experimental study was made of some solid solutions in paradibromobenzene for the quadrupole resonance of Br^{79} nuclei. From the decrease in area of the line and from its enlargement, a deduction was made of the action ray of the internal tensions caused by different impurities. (tr-auth)

2061

ON A NEW METHOD OF CALCULATING EFFECTIVE CROSS SECTIONS OF NUCLEAR REACTIONS INDUCED BY BREMSSTRAHLUNG γ RADIATION. Robert Basile. Compt. rend. 243, 1759-61(1956) Nov. 26. (In French)

2062

HALF-LIVES OF THE EXCITED LEVELS OF Eu^{153}. Michel Vergnes and Nadine Marty (Collège de France, Paris). J. phys. radium 17, 908-10(1956) Oct. (In French)

2063

THE SLOW-NEUTRON TOTAL CROSS-SECTION OF URANIUM-233. N. J. Pattenden (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 3, 28-32(1956) Aug.

The neutron total cross-section of samples of U^{233} has been measured from 0.0015 to 11 ev. The cross-section of U^{233} at 0.0253 ev was found to be (590 ± 15) barns, and peaks were observed at 1.78, 2.27, 3.7, 4.8, 6.7, and 11 ev. It was not found possible to assign single-level Breit-Wigner parameters to these peaks. (auth)

2064

THE YIELD OF FISSION NEUTRONS PER NEUTRON ABSORBED FOR Pu^{239} UP TO 60-EV INCIDENT ENERGY. F. J. M. Farley (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 3, 33-44 (1956) Aug.

The yield of fast neutrons from plutonium discs is measured with a high-pressure methane counter for incident neutron energies up to 60 ev, using the Harwell time-of-flight neutron spectrometer. By measuring the transmission of the samples under identical conditions, and correcting for scattering, the number of incident neutrons captured in the sample is obtained. The ratio η of the fast-neutron yield to the number of incident neutrons captured is then calculated as a function of incident energy, the calibration constant being obtained by fitting to known values in the region 0.03 to 0.3 ev. The values of η fluctuate widely from resonance, but η appears to be constant within each resonance, and to change smoothly between resonances. A curve of the fission cross-section of Pu^{239} up to 60 ev is also presented. (auth)

2065

THE ENERGY DEPENDENCE OF THE NUMBER OF NEUTRONS PER Pu^{239} FISSION IN THE THERMAL REGION. J. E. Sanders and C. J. Kenward (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 3, 70-1(1956) Aug.

2066

DIRECT MEASUREMENT OF THE ENERGY VARIATION OF η FOR U^{233}, U^{235}, AND Pu^{239}. H. Palevsky, D. J. Hughes, R. L. Zimmerman, and R. M. Eisberg (Brookhaven National Lab., Upton, N. Y.). J. Nuclear Energy 3, 177-87(1956) Oct.

A technique is described that measures directly the energy variation of η, the number of fission neutrons produced per neutron absorbed. When combined with total cross-sections, the method is capable of giving fission cross-sections as well. Results are presented in the energy region near thermal, of importance to reactor design, for U^{233}, and Pu^{239}. Comparison with η computed from total and fission cross-sections shows good agreement for U^{233} and U^{235} but a disagreement outside experimental error for Pu^{239}. An auxiliary experiment demonstrates that ν, the number of neutrons per fission, is constant with energy in the region of interest for Pu^{239}, hence that the discrepancy cannot be ascribed to a ν variation. (auth)

2067

INELASTIC CROSS-SECTIONS FOR FISSION-SPECTRUM NEUTRONS. I. H. A. Bethe, J. R. Beyster, and R. E. Carter (Los Alamos Scientific Lab., N. Mex.). J. Nuclear Energy 3, 207-23(1956) Oct.

The general problem of determining inelastic cross-sections from sphere transmission measurements is considered. Experimental problems encountered in this type of investigation are discussed. Analytical methods of correcting for multiple scattering and other important effects in spherical shells are presented. These methods are applied to the determination of average inelastic cross-sections of many materials for fission spectrum neutrons. Experimental work with U^{238}, Np^{237}, and $Al^{27}(n,p)Mg^{27}$ threshold detectors is evaluated. (auth)

2068

ENERGY LEVELS IN Pb^{205} FROM THE DECAY OF Bi^{205}. M. Schmorak, R. Stockendal, J. A. McDonell, and I. Bergström (Nobel Inst. of Physics, Stockholm) and T. R. Gerholm (Univ. of Uppsala, Sweden). Nuclear Phys. 2, 193-225(1956) Nov.

The energies, spins and parities of 9 excited states in Pb^{205} and the probable energies of 8 additional states have been established by studies of 14.5-day Bi^{205} decay. The experiments include precision energy measurements on conversion lines in permanent magnet and double focusing spectrometers; measurements of coincidences between pairs of conversion lines in a double long lens spectrometer, and coincidences between high energy gamma rays and low energy conversion lines in the same spectrometer adapted for the purpose; measurements of relative gamma intensities in a scintillation spectrometer. Positons were discovered with a maximum energy of 925 kev, establishing the total decay energy of Bi^{205} as 2.65 Mev. The proposed decay scheme contains 28 of the observed transitions and is discussed in the light of the shell model. (auth)

2069

THE ENERGY LEVELS OF Pb^{205}. M. H. L. Pryce (H. H. Wills Physics Lab., Bristol, England). Nuclear Phys. 2, 226-38(1956) Nov.

The energy levels of Pb^{205} are calculated on the shell model, regarding Pb^{205} as three holes in the double closed shell nucleus Pb^{208}. Using energies for single holes derived from data on Pb^{207}, and parameters for their pairwise interaction derived from Pb^{206}, the levels up to 2.6 Mev have been estimated. (auth)

2070

MAGNETIC PROPERTIES OF F^{19} IN THE 197 KEV NUCLEAR LEVEL. P. B. Treacy (Australian National Univ., Canberra). Nuclear Phys. 2, 239-53(1956) Nov.

Gamma rays are observed from the de-excitation of the second excited state of F^{19} produced by inelastic proton scattering. It is found that anisotropy of this radiation is quenched by a uniform magnetic field applied normal to the proton beam, and a measurement of this effect yields the following value for the nuclear spectroscopic splitting factor: $g_{\frac{1}{2}} = 1.8 \pm 0.4$. The degree of anisotropy cannot be influenced by a field applied parallel to the proton beam in the case of solid NaF and MnF_2 targets, but with a gas target of CF_4 such a field restores the undisturbed distribution. This effect is analysed with the aid of energy loss data and implies as an order of magnitude a hyperfine structure constant $a = 0.2 \times 10^{-18}$ erg for the free F^{19} in its ground $P_{\frac{1}{2}}$ state. (auth)

2071

LIFETIME MEASUREMENT BY TIME TO PULSE HEIGHT CONVERSION, APPLIED TO THE 517 KEV LEVEL OF ^{85}Rb. J. G. Siekman (Natuurkundig Laboratorium der Rijks-Universiteit, Groningen, Netherlands). Nuclear Phys. 2, 254-8(1956) Nov.

A simple method based on time to pulse height conversion, which can be used for time delay measurements in the micro-second region, has been developed. Using this method the lifetime of the $g_{\frac{9}{2}}$ level of Rb^{85} occurring in the Kr^{85} decay proved to be $(9.0 \pm 0.4) \times 10^{-7}$ sec, which is in good agreement with earlier measurements, and proves the identity of the γ transitions of about 515 kev occuring in the decay of Kr^{85} and Sr^{85}. (auth)

2072

MAGNETIC AND SCINTILLATION SPECTROMETERS; THE CASE OF THE γ-RAYS OF $^{228}_{90}Th$ AND ITS DECAY PRODUCTS. B. Chinaglia and F. Demichelis (Istituto di Fisica Sperimentale del Politecnico–Torino). Nuovo cimento (10) 4, 1160-4(1956) Nov.

The γ spectrum of Th^{228} in equilibrium with its decay products by means of a scintillation spectrometer, and particularly the γ spectrum of Po^{212} were investigated. The results are in agreement with those of others. The reliability of the results is discussed. These are compared with those obtained by means of the magnetic spectrometer. (auth)

2073

PROTON-EXCITED ENERGY LEVELS IN ^{14}N. E. J. Burge (King's Coll., Univ. of London) and D. J. Prowse (Univ. of Bristol, England). Phil. Mag. (8) 1, 912-17(1956) Oct.

The nuclear energy levels of N^{14} have been investigated up to an energy of 7.7 Mev by inelastic proton scattering. All the known levels appear to participate in the scattering. The energies of the levels have been determined as: 7.60 ± 0.02, 7.40 ± 0.02, 7.03 ± 0.02, 6.46 ± 0.02, 6.23 ± 0.02, 5.83 ± 0.03, and 5.69 ± 0.03 Mev. Some evidence was obtained for a level at 5.95 Mev, and a probable new level was observed at 6.60 ± 0.04 Mev. (auth)

2074

THE RATIO OF K-CAPTURE TO POSITRON EMISSION IN FLUORINE 18. R. W. P. Drever, A. Moljk, and J. Scobie (Univ. of Glasgow, Scotland). Phil. Mag. (8) 1, 942-8(1956) Oct.

The existence of electron capture in the decay of F^{18} has been revealed by the detection of K-radiations of oxygen in a proportional tube spectrometer containing a gaseous BF_3 source. The K/β^+ ratio determined from the number of counts in the observed K-peak and the total number in the positron spectrum is 0.030, with an estimated accuracy of 6%. A scintillation spectrometer investigation showed the absence of any gamma rays with intensity greater than 0.5% of the positrons, suggesting that both K-capture and beta decay are ground state to ground state transitions. A comparison between theoretical and measured values of the K/β^+ ratio gives, for the ratio of the axial vector and tensor coupling constants, $C_A/C_T = (0.4 \pm 2)\%$. (auth)

2075

LONG RANGE NUCLEAR INTERACTION IN PARAMAGNETIC RESONANCE. J. E. Bennett and D. J. E. Ingram (Univ. of Southampton, England). Phil. Mag. (8) 1, 970-3(1956) Oct.

A study was made of the hyperfine structure of paramagnetic resonance spectrum of Cu tetraphenyl porphine. (J.H.M.)

2076

THE BOMBARDMENT OF OSMIUM BY NITROGEN IONS. G. W. Greenlees and L. G. Kuo (Univ. of Birmingham, England). Phil. Mag. (8) 1, 973-5(1956) Oct.

Experiments on the heavy ion bombardment of Os to examine the activities of the target atoms are discussed. (J.H.M.)

2077

GAMMA RADIATION FROM THE DECAY OF $^{238}Pu_{94}$, $^{242}Cm_{96}$, AND $^{243}Cm_{96}$. J. O. Newton, B. Rose, and J. Milsted (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 981-1002 (1956) Nov.

Accurate energy measurements on the γ rays from the decay of Pu^{238} and Cm^{242} have been made with proportional counters. Values of 43.49 ± 0.08, and 99.8 ± 0.04, and 153.1 ± 0.6 kev for Pu^{238}, and 44.03 ± 0.06, 101.80 ± 0.17 and 157.61 ± 0.3 kev for Cm^{242} were obtained. The ratios of these energies for each nuclide agree well with those predicted in the strong coupling limit of the Unified model. Gamma rays having energies of 210 ± 1.5, 228 ± 2, and 277 ± 2 kev and K−X radiation were found from the decay of Cm^{243}. These γ rays are shown to be magnetic dipole with a 30% mixture of electric quadrupole; the magnetic dipole component is 10^4 times slower than the single particle estimate. (auth)

2078

THE NUCLEAR RADIUS AND POTENTIAL FROM NEUTRON DIFFRACTION SCATTERING. Richard Wilson (Harvard Univ., Cambridge, Mass.). Phil. Mag. (8) 1, 1013-26(1956) Nov.

Neutron diffraction scattering at high energies is discussed and it is shown that two parameters can be derived from the data; the nuclear radius and the nuclear potential, both with little effect of other parameters. These parameters are derived for each nucleus individually. The radius, so derived, is larger than the charge distribution radius. The potential agrees with that derived from the analysis of total cross sections of all elements simultaneously when a nuclear potential with a reasonable taper is assumed. (auth)

2079

COULOMB EXCITATION AND CASCADE DECAY OF ROTATIONAL STATES IN ODD-MASS NUCLEI. N. P. Heydenburg and G. M. Temmer (Carnegie Institution of Washington, Washington, D. C.). Phys. Rev. 104, 981-89(1956) Nov. 15.

The gamma radiation from the first two excited states, as well as the cascade transition between them, was observed by bombarding the following odd-mass rare-earth nuclei with 6-Mev alpha particles: Eu^{151}, Eu^{153}, Gd^{155}, Gd^{157}, Tb^{159}, Ho^{165}, Lu^{175}, Hf^{177}, Hf^{179}, and Ta^{181}. Also detected were x-x, x-γ, and γ-γ coincidences from these nuclei, establishing their previously suggested level schemes. All show rotational spectra except Eu^{151} (N = 88), which was found to have an excitation spectrum very different from that of Eu^{153} (N = 90) in both the intensity and position of the excited states. From the measured branching ratios of the second rotational states, the M1−E2 mixture ratios for the cascade radiation were determined. Combining the mixture ratio with the values of the ground state magnetic moments, the so-called intrinsic and collective g factors from the strong-coupling approximation of the Bohr-Mottelson theory were computed. Two pairs of values are obtained because of the ambiguity in the phase of the mixture ratio. Appreciable deviations from the irrotational value Z/A are observed for the collective g factors. The mixtures determined agree with those known from radioactive decay for first-excited state transitions as predicted by the unified model. (auth)

2080

CONTRIBUTION OF COULOMB EXCITATION TO INELASTIC SCATTERING BETWEEN NUCLEAR RESONANCES. G. M. Temmer and N. P. Heydenburg (Carnegie Institution of Washington, Washington, D. C.). Phys. Rev. 104, 989-92(1956) Nov. 15.

The relative gamma-ray yields were determined for thin targets of F^{19} (198-kev state) and Na^{23} (446-kev state), with protons and alpha particles over energy intervals corresponding to the same values of ξ, the adiabatic parameter in Coulomb excitation. Between the proton resonances the yield ratios agreed closely with those predicted for E2 Coulomb excitation, and differed by about 50% from E1 (or E3) excitation. Thus the nonresonant inelastic scattering yield between proton resonances in these light nuclei can be entirely accounted for by Coulomb excitation of the E2 type. A slight, negative anistropy in the angular distribution of the 446-kev gamma ray following Coulomb excitation of Na^{23} fixed the spin of that state at $^5/_2$+. (auth)

2081

NEUTRON CROSS SECTIONS OF ZINC. D. A. Dahlberg and L. M. Bollinger (Argonne National Lab., Lemont, Ill.). Phys. Rev. 104, 1006-8(1956) Nov. 15.

The Argonne fast chopper was used in a study of neutron resonances in the Zn isotopes. The transmission of normal Zn and samples enriched in Zn^{64}, Zn^{66}, Zn^{67}, Zn^{68}, and Zn^{70} were studied over the energy range 200 to 10,000 ev. Below 5 kev, seven resonances were observed, of which four are assigned to Zn^{67}, two to Zn^{64}, and one to Zn^{68}. The parameters σ_s and Γ are calculated for these levels. A weighted average value of 0.35 is deduced for the radiation width Γ_γ. The strength function $\overline{\Gamma_n{}^0}/\overline{D}$ for Zn^{67} is found to be 3.1×10^{-4} $ev^{-\frac{1}{2}}$. (auth)

2082

DIFFERENTIAL CROSS SECTIONS FOR $C^{12}(d,d)C^{12}$ AND $C^{12}(d,p)C^{13}$. M. T. McEllistrem, K. W. Jones, Ren Chiba, R. A. Douglas, D. F. Herring, and E. A. Silverstein (Univ. of Wisconsin, Madison). Phys. Rev. 104, 1008-17(1956) Nov. 15.

Differential cross sections have been measured as a function of incident deuteron energy for elastic scattering and for the (d,p) reactions to the ground and 3.09-Mev levels of C^{13}. The cross sections have been measured at several angles from 25° (c.m.) to 169° (c.m.) in the deuteron energy range of 1.9 to 3.4 Mev and have an average accuracy of about 5%. Eleven angular distributions were also taken, nine for the reaction $C^{12}(d,p)C^{13}$ and two for the reaction $C^{12}(d,p)C^{13*}$. Many resonances were observed in the elastic scattering and resonances observed in the (d,p) reactions corresponded to several of these. Interference between the stripping and compound nuclear contributions to the (d,p) reaction is clearly indicated. (auth)

2083

SPIN AND PARITY OF THE FIRST EXCITED STATE OF Na^{23}. W. G. Read and R. W. Krone (Univ. of Kansas, Lawrence). Phys. Rev. 104, 1018-20(1956) Nov. 15.

The angular distributions of the 440-kev γ ray resulting from the $Na^{23}(p,p'\gamma)Na^{23}$ reaction have been measured for proton bombarding energies of 1.288 and 1.460 Mev. Decay by inelastically scattered protons is particularly favorable for these two well-isolated resonances in Mg^{24}. The results show a marked anistropy, thereby ruling out the possibility

that the first excited state of Na^{25} has spin $J = 1/2$. Otherwise the experiments do not permit a completely unambiguous assignment. Evidence is presented, however, showing that the most plausible assignment is $J = 5/2+$. (auth)

2084

BETA DECAY OF Tb^{161}. W. G. Smith, J. H. Hamilton, R. L. Robinson, and L. M. Langer (Indiana Univ., Bloomington). Phys. Rev. 104, 1020-25(1956) Nov. 15.

The radiations emitted in the beta decay of 7-day Tb^{161} have been studied with a 180°, 40-cm radius of curvature, shaped magnetic field spectrometer and a scintillation counter. Gamma-gamma coincidence measurements have also been made. The following transitions with multipolarities indicated were observed (energies in kev): 25.5(E1), 48.9(M1), 56.9(E1, tentative), and 74.6(E1). The following beta groups were also observed (energies in kev): 571, 522, 496, and 439. A level scheme incorporating these data is presented. (auth)

2085

FAST-NEUTRON CROSS SECTIONS OF Ge, As, Se, AND Br. M. Z. Zucker (Univ. of Wisconsin, Madison). Phys. Rev. 104, 1025-27(1956) Nov. 15.

The total cross sections of Ge and Se were measured for neutron energies between 60 and 650 kev, and those of As and Br in the energy range from 60 to 3000 kev. A comparison with calculated values is made. (auth)

2086

1.75-MEV RESONANCE IN $C^{13}(P,\gamma)N^{14}$. Jerry B. Marion and Fred B. Hagedorn (California Inst. of Tech., Pasadena). Phys. Rev. 104, 1028-29(1956) Nov. 15.

The energy and width of the well-known 1.75-Mev resonance in the $C^{13}(p,\gamma)N^{14}$ reaction have been investigated by bombarding a thick target of 60% C^{13} with electrostatically-analyzed protons. The resonance energy was determined to be 1746.9 ± 0.8 kev, relative to the $Li^7(p,n)Be^7$ threshold at 1881.1 kev. The observed width was 510 ev. When account is taken of the thermal motion of the target atoms, an upper limit to the resonance width may be set at 400 ev; the contribution to this value of the spread in the beam energy is unknown. If one uses the radiation width previously measured by Seagrave ($\omega\Gamma\gamma = 14.8$ ev), the resonance cross section is $\sigma_R > 64$ mb. The dimensionless reduced proton width (for d-waves) is $\theta_p^2 < 1.5 \times 10^{-3}$. (auth)

2087

TOTAL NEUTRON CROSS SECTION OF CHLORINE AND CARBON. R. M. Brugger, J. E. Evans, E. G. Joki, and R. S. Shankland (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev. 104, 1054-58(1956) Nov. 15.

The total neutron cross section of Cl has been measured with the MTR crystal spectrometer and fast chopper. The Cl cross section drops from 45 b at 0.03 ev to a low of 1.3 b at 5 kev. A sharp resonance is observed in Cl^{35} at 405 ± 6 ev. A two-sample area analysis of this resonance gives the limiting values; $\Gamma > 0.6$ ev and $\sigma_0 > 580$ b. For these limits, $\Gamma_n = 0.14$ ev. Another level was observed at 8.7 ± 0.5 kev. A good fit to the cross-section data is given by a single-level Breit-Wigner formula for a negative-energy resonance in Cl^{35} with spin 2 and the following parameters; $E_0 = -140$ ev $\Gamma_n^0 = 0.72$ ev, $\Gamma_\gamma = 0.48$ ev, $R = 4.74 \times 10^{-13}$ cm, and $\sigma_{pot} = 1.13$ b. From these parameters, one would obtain $\sigma_{incoh} = 7.8 \pm 0.7$ b and $\sigma_{act}(0.025 \text{ ev}) = 34.5 \pm 3.4$ b. The carbon cross section was also measured and appears flat with an average value of $\sigma_T = 4.69 \pm 0.10$ b. (auth)

2088

ELECTROSTATIC ANALYSIS OF NUCLEAR REACTION ENERGIES. R. A. Douglas, J. W. Broer, Ren Chiba, D. F. Herring, and Edward A. Silverstein (Univ. of Wisconsin, Madison). Phys. Rev. 104, 1059-64(1956) Nov. 15.

Electrostatic analysis of incident and product particles has been used to measure the following reaction energies (in Mev): $D(d,H^3)p$ (4.004 ± 0.005); $D(d,He^3)n$ (3.271 ± 0.011); $C^{14}(d,\alpha)B^{12}$ (0.362 ± 0.002); $C^{14}(d,p)C^{15}$ (-1.007 ± 0.001); $B^{10}(\alpha,d)C^{12}$ (1.341 ± 0.002); $O^{16}(d,p)O^{17*}$, 0.87 level (1.048 ± 0.002); $N^{14}(d,p)N^{15*}$, 7.31 level (1.308 ± 0.002); 7.58 level (1.045 ± 0.002); 8.32 level (0.296 ± 0.001) and 8.57 level (0.038 ± 0.001); $C^{12}(d,p)C^{13*}$ 3.68 level (-0.960 ± 0.002) and 3.86 level (-1.130 ± 0.002) and $N^{14}(d,\alpha)C^{12*}$ 9.6 level (3.933 ± 0.014). The 30-kev width of the 9.6-Mev level of C^{12} limits the spin and parity assignment to 0^+, 1^-, 2^+, or 3^-, or possibly 4^+. (auth)

2089

STUDY OF THE REACTION MECHANISM FOR (He^3,p) REACTIONS WITH Li^6, B^{10}, AND C^{13}. J. P. Schiffer, T. W. Bonner, R. H. Davis, and F. W Prosser, Jr. (Rice Inst., Houston, Texas). Phys. Rev. 104, 1064-68(1956) Nov. 15.

Excitation curves and angular distributions have been obtained for five (He^3,p) reactions in which the initial and final states were of known spins and parities. The results give information on the reaction mechanisms involved. All the reactions studied showed resonances in the excitation curves indicating that the reactions proceeded at least in part by way of a compound system. In one or possibly two cases, the angular distributions showed a strong asymmetry about 90°, suggesting the admixture of some other reaction mechanism. (auth)

2090

COULOMB EXCIATION OF V, Ni, Ga, and Rb. L. W. Fagg, E. H. Geer, and E. A. Wolicki (Naval Research Lab., Washington, D. C.). Phys. Rev. 104, 1073-76(1956) Nov. 15.

The Coulomb excitation of several odd-Z or odd-N medium-weight nuclei has made possible the observation of the following gamma rays: V^{50}, 226 kev; Ni^{61}, 70, 282, and 657 kev; Ga^{69}, 322 kev; Ga^{71}, 513 kev; Rb^{85}, 148 kev; Rb^{87}, 407 kev. Values of the reduced transition probability for excitation are given for each of the above gamma rays. Level schemes are proposed based on coincidence studies and excitation curves. Bombardment of the enriched odd-A isotopes of tin, Sn^{115}, Sn^{117}, and Sn^{119}, produced no observable gamma rays. (auth)

2091

THE FERMI, OR EXCHANGE, HOLE IN ATOMS. V. W. Maslen (Mathematical Inst., Oxford). Proc. Phys. Soc. (London) A69, 734-40(1956) Oct.

Slater has recently introduced the concept of an averaged exchange hole as a basis for an approximation to the exchange potential, which arises in the Hartree-Fock equations. Use of the density matrix leads to a natural definition of the exchange hole which is identical with that obtained in a different manner by Slater. The distribution, size and shape of the exchange hole have been studied for Ne and A, using Slater wave functions, and the results give further information concerning the nature of the hole. The Slater approximation of a spherical exchange charge, centered at the electron, is discussed. (auth)

2092

ELASTIC SCATTERING OF 18.7 MEV PROTONS BY NICKEL AND COPPER NUCLEI. R. A. Vanetsian and E. D. Fedchenko. Soviet Phys. JETP 3, 624-6(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 577-8(1956) Mar. (In Russian).

The differential cross section for the elastic scattering of 18.7-Mev protons from the neighboring nuclei Ni and Cu was investigated. The differential cross section for elastic scattering was measured at 5 intervals from 20 to 170°. (F.S.)

2093

THE ELASTIC SCATTERING OF PROTONS BY TRITIUM. L. A. Maksimov. Soviet Phys. JETP 3, 642-3(1956) Nov.

(In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 615(1956) Mar. (In Russian)

2094

ISOMERIC STATES OF DEFORMED NUCLEI. L. K. Peker (Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 3, 645-7(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 616-17(1956) Mar. (In Russian)

Taking into account the deformation of the nucleus removes the difficulties usually found in analyzing isomeric states with the single-particle model. (F.S.)

2095

MAGNETIC ANALYSIS STUDY OF ENERGY LEVELS OF S^{33}. L. M. Khromchenko (Radium Inst., U.S.S.R.). Soviet Phys. JETP 3, 631-4(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 681-5(1956) Apr. (In Russian)

The energy of protons from the reaction S^{32} (d,p) S^{33} has been analyzed magnetically. A total of 21 proton groups has been observed corresponding to the ground state and 20 excited levels of S^{33}. The region of excitation energies up to 9.2 Mev was investigated. Besides 12 already known levels 8 new ones have been found in the region of high excitation. (auth)

2096

MAGNETIC ANALYSIS OF THE (d,p) REACTION PRODUCTS IN THE INVESTIGATION OF SPIN AND PARITY OF LEVELS OF THE DAUGHTER NUCLEUS. Iu. A. Nemilov and V. F. Litvin (Radium Inst., U.S.S.R.). Soviet Phys. JETP 3, 523-6(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 686-9(1956) Apr. (In Russian)

The energy dependence of the intensity ratio of different proton groups from the reaction Al^{27} (d,p) Al^{28} has been utilized to determine possible spin and parity values of some levels in Al^{28}. The obtained results give for the level at 1.625 Mev; even parity, spin between 0 and 5; at 5.128 Mev: odd parity, spin between 0 and 6, and at 5.435 Mev: odd parity, and spin between 1 and 4. (auth)

NUCLEAR REACTORS

2097 APAE-Memo-7

Alco Products, Inc., Schenectady, N. Y.

ANALYSIS OF PRIMARY SYSTEM BLOWDOWN BY RUPTURE DISC FAILURE. Carl G. Johnson. Jan. 27, 1956. 12p. Contract [AT(11-1)-318]. $3.30(ph OTS); $2.40(mf OTS).

The time required for blowdown of the primary system when the rupture disc fails in the APPR was determined. The effect of blowdown on control rods during scram was evaluated. (F.S.)

2098 APAE-Memo-16

Alco Products, Inc., Schenectady, N. Y.

THERMAL STRESSES IN THE PRESSURE VESSEL OF THE APPR-1. H. Kroeger and T. M. Silks. May 1, 1956. 17p. Contract [AT(11-1)-318]. $3.30(ph OTS); $2.40 (mf OTS).

2099 APAE-Memo-25

[Alco Products, Inc., Schenectady, N. Y.]

APPR-1 LOW POWER TEST PROGRAM AT THE ALCO CRITICAL FACILITY. W. R. Johnson. June 7, 1956. 4p. Contract [AT(11-1)-318]. $1.80(ph OTS); $1.80(mf OTS).

The proposed APPR-1 test program at the Alco critical facility is to include methods for reaching criticality with a minimum number of fuel elements, studies of supercritical arrays by adding fuel rods, and techniques for control rod calibration and evaluation at low power. The temperature coefficient of reactivity will be determined from room temperature to 200°F with heated water in the tank. (F.S.)

2100 APAE-Memo-31

Alco Products, Inc., Schenectady, N. Y.

CALCULATION OF RESIDUAL ACTIVITY IN APPR-1 REACTOR COMPONENTS AFTER SHUTDOWN. F. B. Fairbanks and D. C. Morse. June 27, 1956. 10p. Contract DA-44-009-Eng-2864.

The feasibility with respect to the radiation hazard in disassembling the APPR after shutdown and shipping was examined. Reactivity was calculated for the control rod basket, rod drive, thermal shield, pressure vessel and its bid. (F.S.)

2101 APAE-Memo-37

Alco Products, Inc., Schenectady, N. Y.

CALCULATION OF RESIDUAL ACTIVITY IN APPR-1 SHIELDING RINGS AFTER SHUTDOWN. F. B. Fairbanks and D. C. Morse. July 16, 1956. 7p. Contract DA-44-009-Eng-2864.

2102 APAE-Memo-50

Alco Products, Inc., Schenectady, N. Y.

TIME BEHAVIOR ANALYSIS OF THE PHOTONEUTRON AND POLONIUM–BERYLLIUM SOURCES IN THE APPR-1. J. H. Rosolowski. Aug. 21, 1956. 13p. Contract AT (11-1)-318. $3.30(ph OTS); $2.40(mf OTS).

The time behavior of the strength of the Po-Be source to be used in the APPR-1 was investigated assuming that, besides the Po decay, burnup of the Po and Be is taking place. The results indicate that the initial source strength will be 3.8×10^7 neutrons per second and will decay exponentially with a half life of about 138 days. The effect of the burnup was found to be small. A correction for change in Po distribution due to elevated source temperature was indicated. The strength of the photoneutron source was found for various times after shutdown assuming that it is irradiated by the gammas from fission products formed in the core during 1000 hours of operation at 10 megawatts. The number of neutrons formed per second was found to vary from about 8×10^7 to 3×10^7 in a period from 6 hours to 9 days after shutdown with 70% of the change occurring in the first 3 days. An analysis for the case of the photoneutron source being irradiated only by the gamma photons coming from the activated shielding material shows that only a few thousand neutrons are formed per second. (auth)

2103 APDA-111

Atomic Power Development Associates, Inc., Detroit.

TRANSIENT TEMPERATURE SIMULATION OF REACTOR PRIMARY LOOP. Richard G. Olson and Donald J. Ritchie. Feb. 1, 1956. 159p. $24.30(ph OTS); $7.50(mf OTS).

A simulator study was performed during the months of October and November, 1955, to determine the transient behavior of the power and of the fuel and coolant temperatures of the proposed APDA Developmental Fast Breeder Reactor. Primary loop transient temperatures were also computed. The simulator study was carried out on a Reeves Electronic Analog Computer. A single lumped primary loop was used to simulate the three parallel heat transfer primary loops of the reactor. Both a lumped single point reactor and a five-section core reactor were considered. (auth)

2104 APDA-115

Atomic Power Development Associates, Inc., Detroit.

ENRICO FERMI FAST BREEDER REACTOR PLANT. Nov. 1, 1956. 107p. $0.55(OTS).

This report contains a description of the reactor plant portion of the Enrico Fermi Atomic Power Plant, with emphasis on the reactor system. Since this plant contains a developmental reactor, emphasis has been placed on reactor safety and on achieving reliable operation. The design is conservative and is flexible enough to permit

incorporation of the results of developmental programs, which include nonnuclear, full-scale component test facility operations, and nuclear experiments, such as critical experiments. The complete reactor plant is being built in accordance with the ASME Code, wherever the code applies. The schedule for construction provides one year for non-radioactive mechanical operations and for making modifications. It also provides for a 9-month pre-operational period after the reactor goes critical. During this time the nuclear characteristics will be checked at low power with the fission product activity at a low level. The design of the reactor system is summarized. (auth)

2105 CF-55-7-64
Oak Ridge National Lab., Tenn.
SOME HEAT REMOVAL CONSIDERATIONS OF THE HRT PRESSURE VESSEL DURING OPERATION. R. E. Aven. July 15, 1955. Changed from OFFICIAL USE ONLY Nov. 1, 1956. 22p. Contract W-7405-eng-26. $4.80 (ph OTS); $2.70(mf OTS).

It is shown how the temperature at any point in the HRT pressure vessel may be calculated. Temperature profiles vs. power level and curves of stress vs. heat removal rate from outside surface of pressure vessel at various power levels are presented. The temperature drop across the blanket film and the total tangential stress in the pressure vessel wall are given for a pure D_2O blanket and for a 312.3 g U/liter $UO_2SO_4-D_2O$ blanket solution. (T.R.H.)

2106 CF-55-8-188
Oak Ridge School of Reactor Technology, Tenn.
IMMISCIBLE-LIQUID-COOLED, FLUID-FUEL REACTOR. W. D. Burch, C. H. Cater, D. L. Hathway, B. S. Maxon, N. R. Williamsen, and O. O. Yarbro. Aug. 1955. Decl. Mar. 19, 1956. 141p.

A central station power fluid fuel reactor has been designed in which heat is removed by direct contact of the fuel with an immiscible coolant. Object of this design is to minimize fuel holdup outside the reactor core by utilizing the excellent heat transfer characteristics of direct contact cooling. (auth)

2107 CF-55-9-133 and Suppl.
Oak Ridge National Lab., Tenn.
ORACLE CODE FOR A GENERAL TWO-REGION, TWO-GROUP SPHERICAL HOMOGENEOUS REACTOR CALCULATION. T. B. Fowler. Sept. 22, 1955. 38p. $6.30 (ph OTS); $3.00(mf OTS).

Included in this report is CF-55-9-133(Suppl.) Oct. 7, 1955. 4p.

A general code has been written for the ORACLE for the solution of a spherical, homogeneous, two-region reactor by the two-group method. The reactor is general in that the core and blanket compositions are entirely arbitrary. The calculation can accommodate two fuel components plus seven other nuclear components in the blanket; two fuel components, poisons, moderator, and four other nuclear components in the core. The reactor may or may not contain a core tank separating the two regions. The only restriction in the composition is the requirement that the ratios of the concentration of one of the core fuel components to the concentration of the other core components (except moderator) be independent of core fuel concentration. The volume fraction of core moderator is assumed to be independent of core fuel concentration. For this calculation, the reactor dimensions and blanket composition are fixed; hence, the core composition is the variable for which a solution is sought. (auth)

2108 CF-56-11-90
Oak Ridge National Lab., Tenn.
EFFICIENCY OF HRT PRESSURIZER HEATER INSULATION. R. F. Hughes. Nov. 13, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Tests which permit a direct measurement of the efficiency of the Al concentric cylindrical shell-type insulation assembly for the HRT pressurizer heater are discussed. (auth)

2109 CF-56-11-132
Oak Ridge National Lab., Tenn.
TREATMENT OF THE HRT STEAM SYSTEM WATER. H. A. McLain. Nov. 29, 1956. 32p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Recommendations are made for possible chemical treatment of the water in the HRT steam system. The effectiveness of various chemical additives is unknown because of the presence of radiation in the HRT fuel heat exchanger. Initially it is recommended that the water be treated with sodium phosphates and hydrazine. The sodium phosphates were used for pH control and the prevention of caustic cracking, and the hydrazine is used as an oxygen scavenger. If the hydrazine fails to be satisfactory for the HRT steam system, the use of sodium sulfite for an oxygen scavenger is recommended. The latter would tend to cause foaming in the boiler and would probably require a large amount of blowdown in order to keep the sulfate concentration to a reasonable level. In all cases, the chemicals to be added to this steam system must be free of chlorides. Samples are to be taken from ten points of the HRT steam system in order to keep careful control of the chemical addition. This is particularly important during the initial use of a particular additive. A development program is recommended for the treatment of the water in the homogeneous reactor steam systems because of the lack of knowledge in this area. (auth)

2110 CF-56-12-36
Oak Ridge National Lab., Tenn.
CALCULATION OF AIR SCATTERED GAMMA RADIATION ESCAPING THROUGH A SHIELD OPENING—APPLICATION TO THE HRT. H. C. Claiborne and T. B. Fowler. Dec. 5, 1956. 12p. Contract [W-7405-ENG-26]. $3.30 (ph OTS); $2.40(mf OTS).

A method was developed for calculating air-scattered γ-radiation escaping through openings in a biological shield. The method was applied to the HRT and the results indicated that air scattering was insignificant compared to the other mechanisms contributing to the escape of γ-rays through shield openings. (auth)

2111 CF-56-12-38
Oak Ridge National Lab., Tenn.
POWER COST ASSOCIATED WITH USE OF N^{15} IN BREEDER REACTORS. Paul R. Kasten. Dec. 7, 1956. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Based on a 2-region reactor in which 5% of the total power is generated in a 1,000 gm Th/l blanket, the power cost associated with NO_3-decomposition would be 140 mills/kwh, if N^{15} cost $1/gm. If $HN^{15}O_3$ could be obtained from a nearby plant (at an estimated cost of $3/lb) the power cost would be reduced to 4 mills/kwh. Calculations for other situations are given, however, the use of N^{15} in Th breeder blankets is not economically attractive. (T.R.H.)

2112 CF-56-12-48
Oak Ridge National Lab., Tenn.
RUN SUMMARY OF HRT-CP-7. R. H. Winget. Dec. 12, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

In a run to determine the efficiency of the hydroclone in removing solids of low concentration, the solids were reduced by a factor of ~25/h to a minimum of 0.005 mg/ml.

Eleven grams of solids were added and 67% were recovered. A leak at the flange of a pump terminated the run. (F.S.)

2113 CF-56-12-49
Oak Ridge National Lab., Tenn.
SUMMARY OF RUN HRT-CP-6. R. H. Winget. Dec. 3, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The 400-mill hydroclone was tested for removing injected solids of low concentrations. The solids concentration showed no consistent downward trend, but concentrations decreased rather uniformly with a half life of about 2-½ hrs. A total of 14.17 g were added and 7.77 g were recovered. (F.S.)

2114 HW-33912
Hanford Atomic Products Operation, Richland, Wash.
REACTIVITY CHANGES AND ISOTOPE YIELDS AT HIGH EXPOSURES. J. R. Triplett. Jan. 20, 1955. Decl. Dec. 18, 1956. 45p. Contract W-31-109-Eng-52. $10.80 (ph OTS); $3.90(mf OTS).

The isotope yield equations for uranium irradiation in thermal reactors are formulated as a non-linear system which accounts for changes in resonance absorption due to changes in isotopic composition. Reactivity and composition parameters are presented for the exposure range 0 to 13000 megawatt days per standard ton, for initial U^{235} concentrations between 0.2% and 1.8%, and initial U^{238} resonance escape probabilities of 0.7, 0.8, and 0.9. A single neutron temperature, kT = .05 ev, was assumed. (auth)

2115 HW-43547(Del.)
Hanford Atomic Products Operation, Richland, Wash.
HANFORD TEST PILE. M. V. Davis and H. A. Fowler. June 7, 1956. Decl. with deletions Dec. 18, 1956. 59p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

A complete description is given of the Hanford Test Pile, a heterogeneous, low power, graphite moderated natural U reactor. The operating procedures used are outlined, and the latest results of calibrations performed are included. (B.J.H.)

2116 HW-44525
Hanford Atomic Products Operation, Richland, Wash.
PHYSICS RESEARCH QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1956. July 25, 1956. 75p. Contract W-31-109-Eng-52. $0.45(OTS).

The Lattice Testing Reactor has been used to measure k_∞ for a number of lattices. The temperature coefficient of this reactor has been measured. End effects on the measurement of k_∞ have been investigated. A series of measurements of the bucklings of enriched (1% U^{235}) U-graphite lattices are reported. Calculations are reported on the equilibrium parameters of Pu in a steady state U–Pu cycle reactor, on the reactivity effects of various coolants in a U-graphite lattice, on multiplication factors of homogeneous enriched U-water systems, and on neutron interaction between separated fissile systems. Measurements are reported on a precise determination of the U^{235} fission cross section with respect to Au^{197}, on the slow neutron fission cross section of Pu^{240}, and on the variation of η (Pu^{239}) with neutron energy. An analysis of the Pu^{239} fission cross section is given. A series of measurements on the critical masses of enriched U slugs in water is reported and analyzed to determine safe masses for handling. The energy losses of fission fragments in the U crystal are calculated and results are given. (For preceding period see HW-43441.) (auth)

2117 KAPL-1550
Knolls Atomic Power Lab., Schenectady, N. Y.
FLUX PEAKING NEAR REACTOR WATER GAPS. L. S. Ring and J. C. Stewart. July 19, 1956. 59p. Contract W-31-109-Eng-52. $0.40(OTS).

The flux peaking associated with plane, tee, wye, and cross-shaped water gaps in an enriched-fuel, water-moderated assembly has been measured as a function of water channel width and of the thermal macroscopic absorption cross section of the core. The data have been compared, by a least-squares method, with the flux distribution resulting from superposition of a number of semi-infinite thin source solutions of the thermal diffusion equation. The resulting peaking factors, P (ratio of the flux at the edge of the water gap to the asymptotic flux), and thermal diffusion lengths, L, are given as functions of geometry and core composition. For comparison, P and L have been calculated from the geometry and nuclear properties for each case. The measured values of L do not exhibit the expected dependence on core composition; however, large uncertainties must be attached to the diffusion lengths inferred from the experimental data. These uncertainties are inherent in this experimental method of determining L because of the insensitivity of the functional dependence of P on L; they do not reflect poor experimental techniques. The average deviation of (P-1) from the calculated values is 12%. The average deviation in P itself, however, is only 6% and the largest individual deviation in P is 15%; this indicates the degree of confidence with which P may be calculated for other geometries by the methods used. (auth)

2118 KAPL-M-HH-10
Knolls Atomic Power Lab., Schenectady, N. Y.
THE USE OF ORGANIC FLUIDS IN SIMULATING HOT REACTOR CONDITIONS. H. Hurwitz, Jr. and J. H. Smith. Nov. 13, 1956. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The substitution of organic fluids for cold water as the moderator of a critical assembly can furnish information relating to the reactivity effect resulting from the density change which would occur if the water were heated to high temperature. If reactivity changes due to change in moderators may be regarded as a linear function of the change in moderator composition as measured in moles of carbon, hydrogen, and oxygen per cubic centimeter, it is possible to determine by experimental methods those moderator compositions which are equivalent to hot water at various temperatures. (auth)

2119 KAPL-M-RTF-4
Knolls Atomic Power Lab., Schenectady, N. Y.
EXPLOSIVE RUPTURE OF PRESSURIZED WATER SYSTEM; UPPER AND LOWER BOUNDS FOR FINAL PRESSURE, TEMPERATURE AND MISSILE ENERGY. R. T. Frost. Apr. 10, 1956. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The irreversible expansion of the contents of a pressurized hot water system following an assumed failure of the pressure vessel is discussed. These calculations of final temperatures, pressures, and work are required in the safeguards analysis of the ANARPA pressure cell experiments and may be useful in connection with other similar proposed experiments. (auth)

2120 LA-1441
Los Alamos Scientific Lab., N. Mex.
BURST CHARACTERISTICS ASSOCIATED WITH THE SLOW ASSEMBLY OF FISSIONABLE MATERIALS. G. E. Hansen. July 1952. Decl. Dec. 5, 1956. 39p. Contract W-7405-eng-36. $0.40(OTS).

Estimates are given of temperature rise and pressure developed as a result of active material slowly being driven supercritical. Marginal assembly rates can thus be determined for both metal and solution assemblies above

which the disassembly by thermal expansion is explosive in the sense that the active material or containing vessel is ruptured. (auth)

2121 NP-5997

SOME ASPECTS OF ATOMIC POWER DEVELOPMENT IN THE U.S.S.R. I. V. Kurchatov. 1956. 12p.

The reactor development program in the U.S.S.R. is directed toward the development of power and power breeder reactors for large power station operation. Four reactor types are of major interest; heterogeneous H_2O-moderated and cooled, heterogeneous graphite-moderated Na-cooled, fast Na-cooled Pu breeder, and homogeneous D_2O-moderated Th-breeder. A brief discussion of the physics of fast and thermal breeding is given. (D.E.B.)

2122 ORNL-1796

Tennessee. Univ., Knoxville.

THE COMBINATION OF HYDROGEN AND OXYGEN IN PLATINUM CATALYZED FLOW REACTORS. Harold J. Garber and Fred N. Peebles. Oct. 26, 1954. Decl. Aug. 29, 1956. 80p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract S-370. $13.80(ph OTS); $4.80(mf OTS).

A mathematical basis for engineering design of packed tube catalytic H_2-O_2 recombiners is offered. Platinum beds in general are treated. (T.R.H.)

2123 WAPD-159

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

NUMERICAL SOLUTION OF THE TWO-GROUP DIFFUSION EQUATIONS IN x-y GEOMETRY. Richard S. Varga. Aug. 1956. 34p. Contract AT-11-1-GEN-14. $6.30 (ph OTS); $3.00(mf OTS).

Consideration is given to the numerical solution of the two-group diffusion equations for a heterogeneous reactor in a rectangular region R of the x-y plane, with external boundary. (auth)

2124 WAPD-RD-40

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR PRESSURE VESSEL TEST PROGRAM. N. J. Palladino. May 16, 1955. 14p., 1 illus. Contract AT-11-1-GEN-14. $7.80(ph OTS); $3.30(mf OTS).

2125 WAPD-RD-66

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR BLANKET SUBASSEMBLY TUBE. N. J. Palladino. July 22, 1955. 2p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

The question of blanket subassembly tube was reviewed and recommendation made that the subassembly be full-length instead of half-length. (auth)

2126 WAPD-TM-24

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

AN ALUMINUM–URANIUM CRITICAL ASSEMBLY IN CYLINDRICAL GEOMETRY. S. H. Levine and P. G. Johnson. Nov. 1956. 30p. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

An Al–U, heterogeneous, water-moderated critical assembly having a metal-to-water ratio (MW) of 1.39 was constructed to measure criticality and reflector savings and the age of the system. The age is inferred from the nonleakage probability. The multiplication curve is somewhat irregular and tends to change it's direction of curvature as it approaches criticality. The age calculated from the measured buckling is in fair agreement with previous experiments. (F.S.)

2127

NUCLEAR POWER AND GAS TURBINES–I. Atomics 7, 431-36(1956) Dec.

The design of power generating equipment of a closed-cycle gas turbine nuclear power plant having an output of 60 Mw is presented. (auth)

2128

THE PHYSICS OF ADVANCED REACTORS. J. R. Dietrich (Argonne National Lab., Lemont, Ill.). Brit. J. Appl. Phys., Suppl. No. 5, 9-23(1956).

The various promising types of solid fuel power reactors in terms of the neutron-physics characteristics of their moderators, coolants, and fuel cycles are characterized. The neutron-physics design objectives which have the greatest effect on power cost are: use of a fertile isotope U^{238} or Th^{232} as a major source of energy; internal conversion ratio high enough to allow long fuel element life; safety characteristics favorable enough to avoid remote location and high containment cost. These objectives are not restrictive enough to define the "best" reactor type, but they are the major factors in determining the composition and geometric arrangement of specific reactor designs once the type has been chosen. The thermal reactors which are at present being designed or constructed utilize U^{235} as the initial fissile isotope, and there is a strong incentive to utilize ratios of fissile to fertile material which depart as little as possible from the "natural" value. With this additional design restriction, the lattice characteristics appropriate to the various moderator-coolant combinations are still more sharply defined. Examples are drawn from the current group of reactor designs to illustrate these characteristics. The possible consequences of a greater latitude in the choice of fissile-fertile ratio are discussed, and the relative characteristics of the possible fuel cycles are considered. The characteristics of fast reactors fit into a quite different pattern. The possible conversion ratio is high on either fuel cycle, and the reactivity changes associated with fuel burn-up are relatively low simply because of the very large fissle-material content of the reactor. The requirement that the average neutron energy be kept high is a rather restrictive one. It appears now that the range of variation in fast reactor design will be less than that in the thermal reactor field. The characteristics of typical fast reactors are presented, their special problems are discussed, and some recent experimental results are quoted. (auth)

2129

EXPERIMENTAL REACTOR PHYSICS. P. W. Mummery (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys., Suppl. No. 5, 27-32(1956).

The successful design, construction and operation of nuclear reactors requires detailed information concerning the interaction of various nuclear radiations with matter. In principle this can be obtained from a knowledge of fundamental atomic and nuclear properties combined with mathematical analysis. In practice a considerable number of integral measurements are required. These experiments measure combinations of various fundamental atomic and nuclear properties and the predictions of the mathematical analysis. The detailed information required is outlined and various integral measurements are discussed together with their correlation with fundamental data and with various mathematical models. Consideration is given to the use of sub-critical, and low-power and high-power critical reactor assemblies in this field. (auth)

2130

THE ZERO-ENERGY FAST BREEDER REACTOR, ZEPHYR. L. R. Shepherd (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys., Suppl. No. 5, 32-41(1956).

ZEPHYR is a small low-power fast reactor with a plutonium core surrounded by an envelope of natural uranium.

No cooling is required since the maximum operating power is about 2 w. This reactor first diverged in February, 1954, and has been used to make a detailed study of the neutron physics of fast reactors. Of the many aspects investigated, particular attention has been given to a determination of the breeding characteristics of the system and the measurement of the nuclear parameters required for a theoretical interpretation of fast reactors. (auth)

2131

SHIELDING FOR REACTORS. G. C. Laurence (Atomic Energy of Canada Ltd., Chalk River, Ont.). Brit. J. Appl. Phys., Suppl. No. 5, 54-9(1956).

A brief introductory discussion is given of the design of shielding for nuclear reactors. It includes consideration of design requirements, choice of materials and dimensions, nuclear reactions that affect the penetration, heating of the shielding and production of radioactivity in the coolant. Because the basic data available are insufficient for high accuracy in design calculation, the use of very complex theory and very laborious calculation has little advantage. Very approximate methods are used, and allowance made for possible error in calculating the thickness of shielding required. The problem is simplified by neglecting radiation processes that have relatively little effect on the overall penetration, but the importance of these effects depends on the design of the shielding. (auth)

2132

THE CONTROL OF REACTORS. A. J. Salmon (Associated Electrical Industries Ltd., Aldermaston, Berks, England). Brit. J. Appl. Phys., Suppl. No. 5, 59-70(1956).

The concepts of reactivity, neutron lifetime and delayed neutrons are described and their relationships with the rate of change of neutron density and reactor power are discussed. The amounts of reactivity to be controlled in a reactor may be large and varying with time. The various components of this reactivity are noted and discussed. The physical methods of control are surveyed and the safety of reactors is briefly considered. (auth)

2133

THE INSTRUMENTATION OF REACTORS. W. Macrae (C. A. Parsons and Co. Ltd., Newcatle upon Tyne, England). Brit. J. Appl. Phys., Suppl. No. 5, 71-87(1956).

The paper presents a survey of the instruments needed for the normal operation of reactors. All reactors produce power: the instruments used for its measurement and control and its effect on the temperature of the reactors components are described. These include instruments operated from detectors sensitive to neutron flux and those concerned with physical measurements such as temperature and flow of coolant. The principles of operation of the various instruments are described and their relative importance under various operating conditions indicated. In power reactors instruments are also necessary for the determination of the change of the neutron flux pattern with time and for the detection of faults in protective fuel containers. The basic principles of such instruments are described. An assessment of the essential instruments for a large power producing reactor is made. (auth)

2134

THE CANADIAN RESEARCH REACTORS AND THEIR USES. W. B. Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Brit. J. Appl. Phys., Suppl. No. 5, 96-100(1956).

The heart of the program at Chalk River is the high-flux, heavy-water-moderated NRX reactor. The primary aim justifying this and the even more costly NRU reactor is to explore the possibilities of deriving low-cost electricity from nuclear energy. This aim is not, however, pursued narrowly and the reactors are used to foster basic research in nuclear physics, nuclear chemistry, radiation physics, chemistry, and biology. Since separated fissile material has high intrinsic value in atomic energy research, emphasis has been and still is given to the production of Pu and U^{233} as well as to certain radioisotopes, H_3 and Co among others. Nuclear power will become important within Canada only if it is cheaper than power from the present-day alternatives. The more costly of these are coal in Ontario, coal and oil in the Maritime Provinces, and oil in remote industrial installations such as mines and wood-pulp mills. Coal in Ontario at $8/ton and contributing 3 mills/kWh to the cost of electricity, sets the major target. Results obtained in the NRX reactor indicate that once the large development costs have been worked off nuclear power costs will be definitely lower than this target. Canada is relatively rich in uranium and must immediately consider the particular requirements of foreign as well as domestic consumers. Consequently the research remains broad, and very full programmes lie ahead, not only for the NRX reactor, but also for ZEEP which is mostly used for measurements on fuel arrangements, and a proposed PTR ("Swimming-Pool" Test Reactor) which will take over the function of ZEEP for measuring reactivity effects of materials, particularly after irradiation. The most powerful and versatile research reactor is, however, the NRU, a heavy-water-cooled and moderated, high-flux reactor, which should be in operation in 1956. (auth)

2135

THE UNITED KINGDOM RESEARCH REACTORS AND THEIR USES. F. W. Fenning (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys., Suppl. No. 5, 100-6(1956).

A brief description and use of the U. K. research reactors is given. Five are in operation: GLEEP, BEPO, DIMPLE, ZEPHYR, and ZEUS. (auth)

2136

BATCH VERSUS CONTINUOUS PROCESSING IN FLUIDIZED NUCLEAR REACTORS. Joseph Halperin and R. W. Stoughton (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 48, 2115-22(1956) Dec.

The effect of batch and continuous processing upon formation of transmutation products and their associated neutron losses have been examined for fluidized reactors. It is concluded that for equal processing periods, a smaller content of higher order by-products (or contaminants) and lower neutron losses will result under many conditions of interest in batch compared to continuously processed reactors. This advantage increases markedly as the order of formation of the by-product increases. In particular, uranium-232 and -234 impurities in uranium-233 produced in a thorium blanket and losses due to fission products produced in a core were examined. (auth)

2137

RE-USE OF COOLING WATER IN AN ATOMIC ENERGY COMMISSION INSTALLATION. Archie L. Biladeau (Idaho Operations Office, AEC, Idaho Falls, Idaho). Ind. Eng. Chem. 48, 2159-61(1956) Dec.

In water-cooled atomic reactors total solids content of less than 0.5 ppm is often required, to hold a minimum the development of radioactivity within the primary coolant stream as it flows through the reactor core. This purity is obtained by ion exchange (demineralization). Ion exchange resins are also used as a bypass cleanup unit in the primary coolant water loop to remove built-up radioactivity. These resins become highly radioactive and are usually buried. Regeneration is possible, but disposal is generally cheaper. Holding the primary coolant water stream at an acceptable radioactive level is costly, but use of bypass cleanup units to eliminate the need for continuous purge permits a considerable saving. Secondary coolant systems are still necessary for dissipation of generated heat. (auth)

2138

THE DYNAMICS OF XENON POISONING OF A NUCLEAR REACTOR. C. P. Caillet and J. Carpentier. J. Nuclear Energy 3, 49-63(1956) Aug. (In French)

The mathematical study of xenon poisoning of nuclear reactors is not possible in most cases, because one meets with nonlinear equations. Analog calculators provide an easy treatment of such problems. It is of special interest to know how the xenon concentration varies, following a more or less rapid decrease of reactor power. Some results obtained on this problem with an analog calculator are presented in the present paper. (auth)

2139

EXPONTIAL PILE EXPERIMENTS WITH NATURAL URANIUM AND HEAVY WATER. R. Persson, E. Bloms jö, M. Bustraan, and R. Meier (AB Atomenergi, Stockholm, Sweden). J. Nuclear Energy 3, 188-206(1956) Oct.

The material buckling of various hexagonal lattices of natural uranium rods (diameter 2.00, 2.53, and 3.05 cm) in heavy water has been determined in an exponential assembly. The diameter of the tank was only 1.0 metre. The detectors used were long BF_3 proportional counters, which give a high counting rate and by a special arrangement eliminate higher radial harmonics. For comparison between different lattices the measurements yield the material buckling to an accuracy better than $\pm 0.05 \cdot 10^{-4}$ cm^{-2}, but the absolute value is less accurate, owing to the uncertainty of the extrapolated radius (±0.2 cm). The multiplication factor is calculated using published values of the disadvantage factor, and the constant η and the resonance integral are evaluated. The possibility of correlating intensity and diffusion length is pointed out. (auth)

2140

PROBLEMS OF LIQUID-METAL-FUELLED REACTORS. B. R. T. Frost (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 373-7(1956) Dec.

The problems associated with bismuth circuits are not so well understood as those involving sodium. Suggested bismuth L.M.F.R. systems are discussed with reference to mass transfer, penetration and corrosion of graphite, and suitability and corrosion behaviour of constructional materials. (auth)

2141

THE WORLD'S REACTORS. NO. 6. CALDER HALL. Nuclear Eng. 1, 388a(1956) Dec.

Parameters and performance data compiled from papers read at the British Nuclear Energy Conference are given for the Calder Hall reactors. (F.S.)

2142

REACTOR PHYSICS. 7. James F. Hill (Reactor School, Harwell, Berks, England). Nuclear Power 1, 345-8(1956) Dec.

The fate of neutrons in a finite multiplying medium is considered and a neutron balance is obtained. An important item is the conversion factor C representing the number of plutonium atoms created from uranium-238 per atom of U-235 destroyed. For a typical graphite moderated, natural uranium reactor the value of C is shown to be about 0.766. The critical size of a bare reactor is derived in terms of Bessel functions and the expression indicates that for a given value of the buckling there are an infinite number of possible values of the extrapolated height and radius of the critical cylinder. There are however minimum values of these parameters, at which the other becomes infinite. (auth)

2143

BESSEL FUNCTIONS OF THE FIRST AND SECOND KIND. Nuclear Power 1, 348a(1956) Dec.

Basic formulas of Bessel functions used in calculating the critical size of reactors are summarized in convenient form and graphs. (F.S.)

Refer also to abstracts 1842 and 1849.

NUCLEAR TRANSFORMATION

2144

ANGULAR DISTRIBUTION OF PROTONS FROM $C^{12}(d,p)C^{13}$ REACTION. Mira K. Jurić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 35-9(1956) Mar.

The angular distribution of protons was measured for the $C^{12}(d,p)C^{13}$ reaction for deuteron energies of 0.60, 0.80, 0.90, 1.000, 1.070, 1.200, 1.300 and 1.450 Mev, with a thin target. The coefficients of Legendre polynomials were calculated and given as a function of energy. (auth)

2145

ANGULAR DISTRIBUTION OF PROTONS FROM $O^{16}(d,p)O^{*17}$ REACTION. Mira K. Jurić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 41-4(1956) Mar.

The angular distribution of protons from $O^{16}(d,p)O^{*17}$ reaction (Q = 1.043 Mev) for the incident deuteron energies E_d = 0.764, 0.800, 0.837, 0.981, 1.047, 1.140, 1.160, 1.260 and 1.399 Mev, was investigated. The coefficients of Legendre polynomials were calculated for the measured angular distribution curves, and are given as the function of energy E_d. The total yields of O(d,p)O and O(d,p)O* reactions were compared and shown as function of E_d. (auth)

2146

ON THE REACTION $O^{17}(p,\gamma)F^{18}$. Milan M. Nikolić, Bogdon Povh, and Črtomir Županičič. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 51-2(1956) Mar.

Activities produced in different metal targets were investigated, and a background activity of two hours was assigned to F^{18} from proton capture in O^{17}. The reaction seems to offer a simple means for investigation of the levels of F^{18} from 5.61 to 8.2 Mev. (L.M.T.)

2147

ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTOPROTONS PRODUCED BY 70 MEV. X-RAYS. W. K. Dawson (Department of Physics, Queen's Univ., Kingston, Ontario). Can. J. Phys. 34, 1480-96(1956) Dec.

Thin foils of aluminum, copper, rhodium, and gold were bombarded with the x-ray beam from the 70 Mev synchrotron. The resulting photoprotons were detected by means of 200μ Ilford C-2 emulsions in a moving-plate camera which enabled energy distributions up to about 16 Mev and angular distributions from 20 to 160 degrees with respect to the x-ray beam to be determined. At least 3500 tracks from each of aluminum, copper, and rhodium and about 2000 tracks from gold were measured. The experimental energy distributions have been compared to evaporation theory with a nuclear temperature independent of excitation energy and a photoelectric formula varying as $E^{-\frac{1}{2}}$. The evaporated component of the observed photoproton energy distributions can be fitted with constant nuclear temperatures of 2.1, 1.1, and 1.0 Mev for aluminum, copper, and rhodium respectively. It has not been possible to give an interpretation of the energy distribution of photoprotons from gold. The angular distribution of photoprotons of energies greater than 8 Mev from aluminum shows a pronounced forward asymmetry while those of lesser energy, as well as photoprotons of all observed energies from copper, appear to have isotropic angular distributions. Higher energy photoprotons from rhodium (E_p > 7 Mev) and gold (E_p > 11 Mev) have angular distributions which are well represented by $I(\theta) = a + b(\sin\theta + p \sin\theta \cos\theta)^2$. This angular distribution is attributed to interfer-

ence between electric dipole and electric quadrupole absorption. (auth)

2148

A STUDY OF He^3 REACTION WITH DEUTERONS. A. P. Klyucharev, B. N. Esel'son, and A. K. Val'ter (Physico-Technical Inst.). Doklady Akad. Nauk S.S.S.R. 109, 737-9 (1956) Aug. 1. (In Russian)

Differential cross sections of the $He^3(d,p)He^4$ reaction under 90° angle in respect to the deuteron beam were measured using different deuteron beam components. The measurement diagram shows that excitation functions reach maximum resonance with deuteron energies of (435 ± 30-kev). The presence of the resonance indicates that the $He^3(d,p)He^4$ reaction takes place with the formation of the component nucleus Li^5 at the excitation level of 16.8 Mev. Absolute values obtained for the reaction cross section in resonance were 63.4 ± 3.2 millibarns. (R.V.J.)

2149

SHORT-PERIOD ISOMERS PRODUCED BY PROTON BOMBARDMENT. O. I. Leĭpunskiĭ, V. V. Miller, A. M. Morozov, and P. A. Yampol'skiĭ (Inst. of Chemical Physics, Acad. of Science). Doklady Akad. Nauk S.S.S.R. 109, 935-7 (1956) Aug. 11. (In Russian)

Investigations were made of short-period isomers with half-decay period from 0.01 to 10^{-8} sec. An impulse proton beam of 20 Mev was used to induce the nuclear excitation. The short-period activity between the impulse intervals (frequency 1 or 2 per sec) were studied, and measurements were made of proton beam intensity up to ~10^9 protons per impulse. Targets were charged with positive charge to eliminate secondary electron effects. The short-period γ-radiation activity from proton bombardment was measured on scintillation counter. Data obtained from Fe, Ti, and S proton radiation revealed activities with $T^1/_2$ = 0.18 ± 0.05 sec (Fe), 0.37 ± 0.05 sec (Ti), 3.4 ± 1.0 sec, and 0.3 ± 1.15 sec (S). In comparing the obtained periods with already known ones it was observed that yields from $Cl^{32}(p,n)$ and $S^{31}(p,pn)$ are equal to ~1 : 6. New γ activities with previously unknown isomers were observed and the tables are given showing the values of half-decay periods, energy, and γ-activity yields for Ti, Cd, Ta, Tl, Pb, and Bi targets. (R.V.J.)

2150

A PROBABLE EXAMPLE OF THE REACTION $K^+ + {}^{12}_6C \rightarrow K^+ + 3{}^4_2He$. F. Anderson, D. Keefe, A. Kernan and J. Losty (Physics Department, Univ. College, Dublin). Nuovo cimento (10) 4, 1198-1200(1956) Nov.

An example of a reaction interpreted as $K^+ + C^{12}_6 \rightarrow K^+ + 3\ \alpha$ is shown and discussed. (T.R.H.)

2151

FURTHER EVIDENCE OF ^{12}C TRIPARTITION INDUCED BY K^+-MESONS. N. N. Biswas, L. Ceccarelli-Fabbrichesi, M. Ceccarelli, K. Gottstein, N. C. Varshneya and P. Waloschek (Max-Planck-Institut fur Physik—Gottingen). Nuovo cimento (10) 4, 1201-3(1956) Nov.

Two instances of the reaction $K^+ + C^{12} \rightarrow K^+ + 3\alpha$ are cited and discussed. The frequent occurrence of large angle scatterings with small energy losses among collisions of K mesons with complex nuclei may be attributed to the many body collision processes with nucleon clusters inside the nucleus. (T.R.H.)

2152

THE REACTION $^9Be(\alpha,n)^{12}C$. D. B. James, G. A. Jones, and D. H. Wilkinson (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 949-63(1956) Oct.

The angular properties of the reaction $Be^9(\alpha,n)C^{12}$ have been investigated in some detail in the range E_α = 0.4 to 1.3 Mev. Analysis of the results in terms of overlapping resonances has led to tentative assignments of spin and parity to certain levels in C^{13}. The possibility that the reaction may proceed partly by a stripping mechanism has been considered; it has been concluded that the results do not specifically demand such a mechanism. (auth)

2153

AN INVESTIGATION OF NEUTRONS FROM THE REACTION $^{10}B(d,n)^{11}C$ AT 1.08 MEV BOMBARDING ENERGY. A. Graue (Univ. of Bergen, Norway). Phil. Mag. (8) 1, 1027-30(1956) Nov.

Angular distributions and energy spectra of the neutrons from the reaction $B^{10}(d,n)C^{11}$ have been measured at 1.08 Mev bombarding energy using the photographic plate technique. Energy levels were found in C^{11} at 2.02 ± 0.04, 4.24 ± 0.03, and 4.73 ± 0.03 Mev. A large part of the reaction cross section must be due to compound nucleus formation. The experimental angular distributions can be adequately represented if a pure stripping curve is added to an isotropic distribution from compound nucleus formation. The orbital angular momentum of the captured protons has been determined. (auth)

2154

AN INVESTIGATION OF THE REACTIONS: $^{10}B(d,n)^{11}C$ AND $^{11}B(d,n)^{12}C$. E. E. Maslin, J. M. Calvert, and A. A. Jaffe (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A69, 754-9(1956) Oct.

The $B^{10}(d,n)C^{11}$ and $B^{11}(d,n)C^{12}$ reactions have been investigated by bombarding the separated isotopes of B^{10} and B^{11} with a beam of 9-Mev deuterons and analyzing the neutron groups with a fast-neutron spectrometer. Angular distributions and cross sections for a number of neutron groups have been measured. The theory of the stripping process has been applied to assign parities to levels in C^{11} and C^{12} and to obtain information about the spins of these levels. (auth)

2155

ANGULAR DISTRIBUTION OF FISSION FRAGMENTS. V. M. Strutinskiĭ. Soviet Phys. JETP 3, 638-40(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 606-8(1956) Mar. (In Russian)

The anisotropic angular distribution of fission fragments from fission induced by fast neutrons, protons, and γ rays was observed experimentally. General features of the angular distribution of the fragments which follow from the conservation of angular momentum were studied. (F.S.)

PARTICLE ACCELERATORS

2156

DETERMINATION OF THE SERIES IMPEDANCE AND OF THE ATTENUATION LENGTH OF A HELICAL WAVE GUIDE FOR A LINEAR PROTON ACCELERATOR. Albert Septier. Compt. rend. 243, 1748-50(1956) Nov. 26. (In French)

2157

CIRCULAR ACCELERATORS (Zirkularbeschleuniger). Von P. Kunze (Physikalisches Institut der Universitat, Rostock). Naturwissenschaften 43, 457-65(1956) Oct.

2158

APPROXIMATIONS FOR LINEAR BETATRON OSCILLATIONS. F. T. Adler and D. Baroncini (Carnegie Inst. of Tech., Pittsburgh). Nuovo cimento (10) 4, 959-74(1956) Nov.

Approximation methods for calculating the characteristic exponent of extended Hill equations are derived and applied to the computation of linear betatron oscillations. (auth)

RADIATION ABSORPTION AND SCATTERING

2159 HEPL-113

Stanford Univ., Calif. High-Energy Physics Lab.

ELECTRON SCATTERING FROM NEIGHBORING NUCLEI. Beat Hahn, Robert Hofstadter, and D. G. Ravenhall. Nov. 1956. 11p. Project R-357-20-9. Contract AF18(600)-646. (OSR-TN-56-536).

A new method of measuring small variations of the charge distributions of neighboring nuclei, such as isotopes and isotones, has been developed. The method is based on a determination of the ratio of electron scattering cross sections near the diffraction dips. Experimental results are given for the combinations Ni^{58}, Ni^{60}, and Fe^{56}, Ni^{58}. Sample theoretical interpretations are presented. (auth)

2160 KAPL-M-EFC-3

Knolls Atomic Power Lab., Schenectady, N. Y.

INELASTIC SCATTERING PARAMETERS OF ZIRCONIUM. E. F. Clancy. Nov. 26, 1956. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

This report is a supplement to KAPL-M-EFC-2.

2161 NARF-56-40T

Convair, Fort Worth, Tex.

ANALYSIS OF PENETRATION OF Co^{60} GAMMA RAYS THROUGH RUBBER SLABS. H. B. VanFleet, F. B. House, and M. L. Coffman. Nov. 30, 1956. 57p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-110).

Experiments were performed on the penetration of gamma radiation through square slabs. These measurements were designed to give information on the build-up due to scattered radiation in rubber. The experimental setup is illustrated. In this setup, a Co^{60} source is selectively shielded by lead bricks and lies in the same horizontal plane as a detector which is mounted behind lead and/or rubber slabs. The thickness of the lead and rubber is variable in multiples of ¼- or 2-in. slabs, respectively. The slabs are mounted on a platform which may be rotated about a vertical axis. Thus, any angle of incidence, θ, from 0° to 90°, may be obtained. The direct beam was shielded by placing an 8-inch thick lead brick on a line connecting the source and detector. This shield has a cross-section of 4 × 4 in. and was 17.5 ft from the source. The source-detector separation distance was 30 ft. The experimental mean free path for 1.25-Mev gamma photons in rubber was found to be about 10 inches. This value was obtained in a collimated-beam geometry. A value near the theoretical value of 6.63 inches should be obtained if narrow-beam geometry is used in the experiments. The build-up in rubber is nearly a linear function of the penetration for over two mean free paths. If feasible, data of a similar nature should be obtained for several mean free paths. Build-up theory and single-scattering theory seem equally good for the purpose of calculating the penetration of gamma rays through slabs. Either of these theories would be greatly enhanced if experimental data taken under cylindrical geometry were available. (auth)

2162 ORNL-2224(Vol. I)

Oak Ridge National Lab., Tenn.

TRANSMISSION OF OBLIQUELY INCIDENT GAMMA-RADIATION THROUGH STRATIFIED SLAB BARRIERS. C. D. Zerby. Dec. 13, 1956. 95p. Contract W-7405-eng-26. $0.50(OTS).

Results are presented from an investigation of the penetration of gamma radiation through stratified slabs using a Monte Carlo method of computation. Since this method provides a bulk of information not generally available as a result of the use of other methods of computation, a considerable effort was made to make available all the data obtained without restriction because of its usefulness in many applications. The data are presented in the form of tables and graphs. A detailed discussion of all methods and techniques used throughout the investigation, along with much of the data in the form of tables and graphs for ease of comparison of results of cases with slightly different boundary conditions are included. (auth)

2163 UCRL-3535

California. Univ., Berkeley. Radiation Lab.

CHEW-THEORY APPROACH TO THE SCATTERING OF LOW-ENERGY K^+ PARTICLES BY NUCLEONS. Henry P. Stapp. Oct. 15, 1956. 27p. Contract W-7405-eng-48. $0.25(OTS).

The method successfully used by Chew in the treatment of pion-nucleon scattering is applied to the scattering of K^+ mesons by nucleons. Two mechanisms are considered. In the first, K mesons are emitted and absorbed directly by the nucleon or hyperon, and in the second the force is transmitted by the π-meson field in the manner proposed by Schwinger. (auth)

2164

THE COMPLETE INCOHERENT SCATTERING FUNCTION FOR CARBON. D. T. Keating and G. H. Vineyard (Brookhaven National Laboratory, Upton, N. Y.). Acta Cryst. 9, 895-6(1956) Nov.

2165

SCATTERING OF HIGH ENERGY ELECTRONS BY CARBON AND THE NUCLEAR DENSITY DISTRIBUTION. L. J. Tassie (Univ. Of Melbourne, Australia). Australian J. Phys. 9, 400-3(1956) Sept.

The elastic scattering of 187-Mev electrons by C^{12} has been calculated, using the Born approximation and independent particle model with spherical box wave functions and with harmonic oscillator wave functions. (auth)

2166

ELASTIC SCATTERING OF DEUTERONS ON Be^9. Mira K. Jurić and Silva D. Ćirilov. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 45-9(1956) Mar.

The angular distribution of the elastically scattered deuterons on Be^9 was measured and compared with Rutherford scattering. An anomalous scattering was found for the deuteron energies E_d = 1.162 and 1.348 Mev, which indicates that there exist the resonant levels of the compound nucleus B^{11}. (auth)

2167

GAMMA QUANTUM EMISSION IN COLLISIONS OF FAST CHARGED π MESONS WITH NUCLEI. A. G. Sitenko (Gorkiĭ Kharkov State Univ.) Doklady Akad. Nauk S.S.S.R. 109, 1119-22(1956) Aug. 21. (In Russian)

Diffraction emissions of γ quantum by fast π mesons considering the Coulomb interactions between π mesons and nuclear charge were studied. The interaction proved especially important for the studies with semi-transparent nuclei. (R.V.J.)

2168

CONNECTION BETWEEN SCATTERING AND MULTIPLE PRODUCTION OF PARTICLES. S. Z. Belenky (P. N. Lebedev Physical Inst., Moscow). Nuclear Phys. 2, 259-66(1956) Nov.

According to Fermi's theory, multiple production of particles in high energy collisions should be determined by the statistical weight of the respective state. In the present investigation the statistical weight is calculated with account of mutual interaction of pairs of particles, and it is shown that in this case the scattering phase of the interacting particles is involved as a characteristic of the interaction. In resonance scattering the effect of the interaction reduces to the appearance of an intermediate "isobaric" state which should be included in the statistical theory. (auth)

2169

SCATTERING IN FIELD THEORY. H. Ekstein (Argonne National Lab., Lemont, Ill.). Nuovo cimento (10) 4, 1017-58 (1956) Nov.

A precise statement of the scattering problem, general enough to include composite particles in field theory, is proposed: the four Heisenberg operators P_μ which represent the total energy-momentum vector, can be expressed asymptotically ($t \to \pm \infty$) as integrals of mutually commuting operators which represent the four-momenta of the incident and outgoing particles, both elementary and composite. For a theory given in terms of bare-particle creation operators a_Γ^+, the problem consists in finding the asymptotic operators $A^{(a)}$ as functions of the a_Γ and a_Γ^+. A system of linear equations for this purpose is derived. Alternatively the S-matrix can be obtained by solving a bi-linear equation, the inhomogeneous term of which consists essentially of products of one-particle state vectors. (auth)

2170

A HIGH ENERGY NUCLEAR INTERACTION. A. Debenedetti, C. M. Garelli, L. Tallone and M. Vigone (Istituto di Fisica dell'Universita-Torino and Istituto Nazionale di Fisica Nucleare-Sezione di Torino). Nuovo cimento (10) 4, 1142-50(1956) Nov.

The $p\beta$ of the secondaries of a high energy jet from scattering measurements was determined. The angular and momentum distribution in the center of mass system was calculated and a good agreement with Heisenberg's and Wataghin's theories was found. Also the value of the percentage of K mesons emitted in the nuclear interaction and an estimate of the mean free path for nuclear interactions of the charged π mesons are given. (auth)

2171

A STUDY ON ELECTROMAGNETIC SHOWERS IN NUCLEAR EMULSIONS. A. Debenedetti, C. M. Garelli, L. Tallone and M. Vigone (Istituto di Fisica dell'Universita-Torino, and Istituto Nazionale di Fisica Nucleare-Sezione di Torino). Nuovo cimento (10) 4, 1151-9(1956) Nov.

A considerable number of electromagnetic cascades have been analyzed to determine the increase of the multiplicity with the primary energy, the spectrum of the energies of the secondaries and the trident production. No appreciable discrepancy from the theory has been remarked. (auth)

2172

ON THE SCATTERING OF HIGH ENERGY ELECTRONS BY PROTONS. E. Clementel and C. Villi (Istituto di Fisica dell'Universita-Padova; Istituto di Fisica dell'Universita-Trieste and Istituto Nazionale di Fisica Nucleare-Sezione di Padova). Nuovo cimento (10) 4, 1207-11(1956) Nov.

Recent experiments in proton scattering of high energy electrons indicate that the measured differential cross section is larger than that of a point proton with no magnetic moment and smaller than the theoretical cross section of a point proton with an anomalous magnetic moment. A mathematical treatment is given of the explanation which supposes that the proton is not a point but a structured object. (T.R.H.)

2173

ON THE RESONANCE NUCLEON-NUCLEUS SCATTERING. E. Minardi (Societa Nazionale Cogne-Aosta and Istituto Nazionale di Fisica Nucleare-Sezione di Torine). Nuovo cimento (10) 4, 1219-21(1956) Nov.

The possibility of applying the solution S' of the equation for the diagonalization of the Hamiltonian to resonance nucleon-nucleus scattering is briefly discussed. (T.R.H.)

2174

THE ELASTIC SCATTERING OF 136 MEV NEUTRONS BY NUCLEI. C. P. van Zyl, R. G. P. Voss, and R. Wilson (Clarendon Lab., Oxford, England). Phil. Mag. (8) 1, 1003-12(1956) Nov.

The neutron elastic scattering cross sections for Pb, Cd, Cu, Al, O_2, N, C, Be, and Li have been measured for an effective neutron energy of 136 Mev. A large liquid scintillator was used, and the cross sections were obtained on an absolute scale. The integrated total elastic cross sections are consistent with previous measurements of total and inelastic cross sections. (auth)

2175

THE SCATTERING OF 130 MEV NEUTRONS BY PROTONS. T. C. Randle, D. M. Skyrme, M. Snowden, A. E. Taylor, F. Uridge, and E. Wood (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 760-6(1956) Oct.

The differential cross section for the scattering of neutrons by protons has been measured at an effective neutron energy of 130 Mev using a diffusion cloud chamber. An asymmetrical distribution with a minimum at a scattering angle of about 80° in the center-of-mass system was obtained. This is in contrast to the near symmetry about 90° indicated by measurements at 90 Mev and with the observation of a minimum at about 100° at higher energies. (auth)

2176

INELASTIC SCATTERING OF PROTONS BY C^{12}. C. P. Browne (Massachusetts Inst. of Tech., Cambridge) and J. R. Lamarsh (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 1099-1101(1956) Nov. 15.

The yield of inelastically scattered protons from the first excited state of C^{12} was measured as a function of bombarding energy from 5.3 to 7.3 Mev. The angular distribution of these protons was also measured at 6.13, 6.51, and 6.90 Mev. The absolute cross section was obtained by comparison with the known (d,p) cross section. The results indicate that, in this energy range, this inelastic scattering process proceeds largely by way of compound-nucleus formation, which obscures any direct interaction effects that may be present. (auth)

2177

FORMATION OF NEGATIVE HYDROGEN IONS BY COLLISION OF PROTONS WITH GAS MOLECULES. Ia. M. Fogel' and R. V. Mitin (Physical and Technical Inst., Ukrainian S.S.S.R.). Soviet Phys. JETP 3, 334-40(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 450-7(1956) Mar. (In Russian)

Measurements were made of effective cross sections of two electron capture by collisions of protons of energies from 9.5 to 29 kev with molecules of H_2, N_2, O_2, He, Ne, and A. The ratio of the number of negative hydrogen ions to the number of protons in the balanced beam formed after the proton beam has passed through the six mentioned gas targets, was determined as a function of energy. The effective cross section of capture of a single electron by collision of a fast hydrogen atom with a hydrogen molecule was computed on the basis of the experimental results. (auth)

2178

ELASTIC SCATTERING OF 5.4 MEV PROTONS BY VARIOUS NUCLEI. A. P. Kliucharev, L. I. Bolotin, and V. A. Lutsik (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 3, 463-5(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 573-4(1956) Mar. (In Russian)

The elastic scattering of 5.4-Mev protons by nuclei of Be, C, F, Mg, Al, Ca, Mn, Ni, Cu, and Zn was studied. The angular distribution differs from Coulomb distribution and was found to be different for various nuclei. (F.S.)

2179

SCATTERING OF 250 MEV PHOTONS BY FREE ELECTRONS. L. V. Kurnosova, L. A. Razorionov, and P. A.

Cherenkov (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 546-9(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 690-4(1956) Apr. (In Russian)

Measurements of the ratio of the scattering cross section for photons of 250 Mev by free electrons in a Be target to the pair production cross section are reported. The apparatus counted the recoil electrons and the pair electrons and positrons in the energy intervals 235 to 247 and 222 to 233 Mev. The observed ratios agree within the accuracy of the experiment with those deduced from the Bethe-Heitler formula for pair production and the Klein-Nishina-Tamm theory for Compton scattering. (auth)

RADIATION EFFECTS

2180 NARF-56-27T

Convair, Fort Worth, Tex.

PROCEDURES FOR SYSTEM PANELS TEST NO. 2. Sept. 7, 1956. 104p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-122).

The GTR will be used to irradiate aircraft components and equipment. The systems to be irradiated are described and procedures for exposure, testing, and handling are established. (D.E.B.)

2181 NARF-56-27T(Add. 2)

Convair, Forth Worth, Tex.

PROCEDURES FOR SYSTEM PANELS TEST NO. 2. Addendum 2. Sept. 7, 1956. 108p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-122-2).

The GTR will be used to irradiate aircraft structures and equipment. The procedures for exposure, testing, and handling a jet engine, hydraulic control system and gear box, electronic components, and electric motors are outlined. (D.E.B.)

2182 NARF-56-27T(Add. 5)

Convair, Fort Worth, Tex.

PROCEDURES FOR SYSTEM PANELS TEST NO. 2. Addendum 5. Sept. 7, 1956. 54p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-122-5).

The GTR will be used to irradiate aircraft structures, components, and equipment. Procedures for exposure, testing, and handling are outlined. (D.E.B.)

2183 NARF-56-27T(Add. 9)

Convair, Fort Worth, Tex.

PROCEDURES FOR SYSTEM PANELS TEST NO. 2. Addendum 9. Sept. 7, 1956. 113p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-122-9).

The GTR will be used to irradiate aircraft structures, components, and equipment. Procedures for exposure, testing, and handling of hydraulic and pneumatic systems are outlined. (D.E.B.)

2184

X-RAY DIFFRACTION STUDIES OF NEUTRON-IRRADIATED GRAPHITE. G. E. Bacon (Atomic Energy Research Establishment, Harwell, Berks, England) and B. E. Warren (Massachusetts Inst. of Tech., Cambridge). Acta. Cryst. 9, 1029-35(1956) Dec.

When graphite is bombarded in a nuclear reactor there is a steady deterioration of the structure with production of interstitial atoms, giving an increase of c dimension and decrease of a. Over a wide range of irradiation the parameter changes are linear with the dose. The amount of damage decreases with increase of the temperature of irradiation and the original structure can be restored by subsequent annealing. A simplified model of the damaged material is set up, involving two parameters α and ϵ, where α is the probability that an occasional interlayer spacing is increased by the amount ϵ. There is some evidence that the interstitial groups tend to position themselves with a degree of regularity. (auth)

2185

RADIATION DAMAGE TO METALS AND ASSOCIATED PROBLEMS. IRRADIATION TECHNIQUES FOR FISSILE MATERIALS. O. S. Plail (Atomic Energy Research Establishment, Harwell, Berks, England). Bull. Inst. Metals 3, 122-6(1956) Oct.

Investigations have been carried on at Harwell into the effects of neutron irradiation on both fissile and non-fissile materials. In general, the more difficult problems of technique are associated with the fissile irradiations, and this paper is concerned mainly with the problems thus encountered. The subject can be dealt with under two main headings. First, there is the sample preparation and actual irradiation (i.e., the exposure of specimens to neutron bombardment) and, secondly, the subsequent examination of the samples when they are themselves highly radioactive. (auth)

2186

THE EFFECTS OF IRRADIATION ON THE PHYSICAL PROPERTIES OF SOLIDS. A. H. Cottrell (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys., Suppl. No. 5, 43-53(1956).

Ionizing radiations dissipate most of their energy in solids by exciting electrons. Severe radiation damage is produced in organic substances by this process, but in metals the free electron structure is immune to ionization damage. Atoms are displaced by collisions with fast particles and the point defects so created alter the electrical and thermal properties of solids. These point defects interact strongly with dislocations so that the mechanical properties of metals are sensitive to heavy-particle bombardment. In semiconductors the displaced atoms can trap electrons and holes, thereby producing large changes in electrical properties. Prolonged bombardments produce drastic effects; some minerals become non-crystalline, uranium crystals change shape, some metals become brittle, and rare gas atoms created by transmutations may produce swelling and disintegration at high temperatures. (auth)

2187

EFFECT OF ELECTRON IRRADIATION ON YOUNG'S MODULUS. H. Dieckamp and A. Sosin (Atomics International, Canoga Park, Calif.). J. Appl. Phys. 27, 1416-18 (1956) Dec.

Young's modulus and internal friction measurements are reported on high-purity Cu following electron bombardment. The modulus is observed to rise rapidly with electron flux reaching an early saturation followed by a slow decrease. The rapid saturation is attributed to dislocation pinning. The rate of saturation is temperature dependent in the range from −195°C to about 0°C suggesting defect migration at low temperatures. The slow decrease is attributed to a "bulk effect" due to interstitial-vacancy pairs. (auth)

2188

DENSITY CHANGES IN NEUTRON IRRADIATED QUARTZ. P. G. Klemens (Commonwealth Scientific and Industrial Research Organization, Sydney, Australia). Phil. Mag. (8) 1, 938-41(1956) Oct.

An explanation is given of the increase in the rate of density change in neutron-irradiated quartz. (J.H.M.)

2189

THE ABSORPTION COEFFICIENT OF β-ENERGY OF RADIOACTIVE ISOTOPES. DOSAGE DISTRIBUTION IN THE ENVIRONMENT OF SMALL RADIOACTIVE BODIES WITH SURFACE EMISSION CORPUSCLES. K. Sommermeyer and K. H. Waechter. Z. angew. Phys. 8, 473-7(1956) Oct. (In German)

RADIOACTIVITY

2190

METHOD OF ABSOLUTE MEASUREMENT OF THE NUMBER OF NEUTRONS EMITTED PER UNIT OF TIME BY A STANDARD Ra–Be SOURCE. Maurice Gailloud. Ann. phys. (13) 1, 805-53(1956) Sept.-Oct. (In French)

2191

COINCIDENCE STUDIES OF GAMMA-RADIATIONS FROM Yb^{169} AND Er^{171}. Stevan D. Koički and Anka M. Koički. Bull. Inst. Nuclear Sic. "Boris Kidrich" (Belgrade) 6, 1-19 (1956) Mar.

Gamma rays from 33 day–Yb^{169} and 7 hour–Er^{171} have been investigated by means of a coincidence scintillation spectrometer. Gamma rays of 63, 93, 110, 132, 178, 198, 260 and 308 kev are found in Yb^{169} and those of 112, 125, 294 and 307 kev in Er^{171}. Decay schemes for both isotopes are proposed and the similarities in the structure of excited states of isotopes Tm^{169} and Tm^{171} discussed. The position of the metastable state is established in both isotopes, as well as the rotational character of first three excited states. The characteristic rotational parameters obtained from proposed schemes are compared with the Bohr-Mottelson theory. (auth)

2192

STUDY OF EMISSION OF LIGHT POSITIVE PARTICLES FROM NEGATIVE BETA EMITTERS. Aleksandar B. Milojević. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 21-34(1956) Mar.

For the study of the emission of light positive particles from negative beta emitters, a method is developed using a small spectrometer for injecting the particles of a given sign in a magnetic Wilson cloud chamber. This method allows the discrimination of the sign of particle tracks in the cloud chamber by a factor of 10^{-2}. At the same time, an analysis of electromagnetic radiations from radioactive phosphorus sample, prepared by the reaction S(n,p)P, was performed with a scintillation gamma spectrometer, and the rate of positron production discussed. The results obtained were in agreement with the theoretical predictions for the internal bremsstrahlung and for the internal pair creation by the emitted negative β rays. By investigating the emission of light positive particles from radioactive P^{32}, it was found that the ratio of positive particles, emitted from the source, per negative β disintegration, is less than 8×10^{-6}. (auth)

2193

DETERMINATION OF THE INITIAL INTENSITY FROM RADIOACTIVE PREPARATIONS AT THE TIME OF MEASUREMENTS WITH ABSORBER DEVIATIONS FROM A NORMAL ABSORPTION CURVE. Vladimir M. Vukanovic and Toma M. Tasovac. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 163-72(1956) Mar. (In French)

A graphical method is proposed for determining initial intensity which allows, using the absorption curve of the standard of the radioactive substance being studied, a more precise determination of the initial intensity of the radioactive substance, without consideration of the ratio between the intensity of the radioelement and that of the standard. (tr-auth).

2194

CAPTURE OF L ELECTRONS IN THE DISINTEGRATION OF Co^{57}. André Moussa and Andrée Juillard. Compt. rend. 243, 1515-17(1956) Nov. 12. (In French)

A direct comparison was made, in a magnetic spectrometer, of the number of K Auger electrons and of the number of conversion electrons from a strongly converted low-energy quantum. Accepting the disintegration scheme, an estimation of the proportion of L captures is deduced: $\lambda_L/\lambda_K = 0.20 \pm 0.13$. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

Refer to abstract 1834.

SHIELDING

2195 APAE-Memo-34

Alco Products, Inc., Schenectady, N. Y.

SHIELDING OF IRRADIATED APPR-1 FUEL ELEMENTS. F. B. Fairbanks and D. C. Morse. July 6, 1956. 9p. Contract AT(11-1)-318). $1.80(ph OTS); $1.80(mf OTS).

The shielding requirements for irradiated APPR fuel elements in storage and in transit to the reprocessing plant were determined. Results are presented for a single fuel element of twice the average activity. The distance indicated is from the surface of the water in the storage tanks to the nearest point of the active core section. (F.S.)

2196 KAPL-M-CJR-2

Knolls Atomic Power Lab., Schenectady, N. Y.

DISTANCE EFFECT ON SHIELD WEIGHT OF SINGLE PIPE ARRANGEMENT. Carol J. Ranney. Feb. 2, 1956. 17p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40 (mf OTS).

The effect of distance between the shield and the parallel coolant pipes has been studied. Calculations of dose rate outside a slab shield from parallel cylindrical sources have been performed, using both the point source equation with Peebles buildup and the line source approximation of a cylinder applying slant penetrations through the shield. It is shown that the slant penetration method gives an unrealistic picture for pipes lying close to the shield. (auth)

SPECTROSCOPY

2197 HW-39536

Hanford Atomic Products Operation, Richland, Wash.

TRANSPARENCY TO FAR INFRARED. R. L. Reynolds. Oct. 15, 1955. 3p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

When an optical material with high transparency to infrared wave lengths as long as 10 microns was required for a temperature indicating apparatus, a literature search failed to disclose applicable information. To supply the missing data, selected samples were tested. The required material was to be ground into a simple convex lens for focusing radiant heat from a 10°C to 100°C specimen onto a thermopile assembly. Because it would be exposed alternately to water and to gamma radiation, resistance was required both to water and to radiation darkening in the longer wave lengths. Potentially applicable materials were irradiated with gamma to 1.5×10^8 roentgen. Transmission was measured before and after irradiation. Transmission curves are plotted. Because the calcium fluoride and arsenic trisulfide samples were convex lenses, these two curves show relative rather than absolute transmission values. Arsenic trisulfide was shown to transmit infrared to beyond 10 microns, and was essentially unaffected by radiation. (auth)

2198

AN INTERESTING CASE OF INTERFERENCE OF THE BORON AND COBALT SPECTRAL LINES IN THE REGION OF 2496 A. Marija P. Mitrović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 6, 153-7(1956) Mar.

The influence of some elements on the intensities of B lines was investigated. An interference of a Co line was observed in the 2496 A region. The 2496.80 A Co line was used as internal standard for the quantitative determination of B. (auth)

2199

ANALYSIS OF ATOMIC SPECTRA WITH ELECTRONIC DIGITAL COMPUTERS. K. G. Kessler, S. B. Prusch, and I. A. Stegun (National Bureau of Standards, Washington, D. C.). J. Opt. Soc. Amer. 46, 1043-5(1956) Dec.

A method has been developed for the analysis of atomic spectra with high speed electronic digital computers. The conversion of wavelength in air to vacuum wave numbers, the search for spectral terms, and the construction of square arrays are performed by machine computation. These techniques are applied to the analysis of the arc spectrum of ruthenium. (auth)

2200

THE INFRA-RED RESONANCE LINES OF LUTETIUM. L. F. H. Bovey, E. B. M. Steers, and H. S. Wise (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 783-4(1956) Oct.

The positions of the multiplets occurring in the infrared resonance lines of Lu were observed. (J.H.M.)

2201

DISINTEGRATION OF POSITIVE IONS IN COLLISION WITH MOLECULES. S. E. Kuprianov, M. V. Tikhomirov, V. K. Potapov, and P. Ia. Karpova (Physico-Chemical Inst.). Soviet Phys. JETP 3, 459-61(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 569-70(1956) Mar. (In Russian)

Broad peaks observed in the mass spectra of compounds whose centers of gravity do not coincide with the integral mass numbers were investigated in the study of the disintegration of positive ions in collision with molecules. (F.S.)

THEORETICAL PHYSICS

2202

ON POSSIBLE INTERPRETATION OF PERTURBATION SERIES IN THE QUANTUM FIELD THEORY. V. I. Ogievetskiĭ (Electrophysical Laboratory Akad. Nauk S.S.S.R.). Doklady Akad. Nauk S.S.S.R. 108, 919-22(1956) Aug. 11. (In Russian)

2203

SPECTRAL REPRESENTATION AND RENORMALIZATION GROUP. A. A. Logunov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 109, 740-2(1956) Aug. 1. (In Russian)

Green's functions for interacting fields are represented as superimpositions of Green's functions of free fields with various masses. Spectral functions are tangible and express accurately the characteristics of the field. (R.V.J.)

2204

ON BOUNDARY CONDITIONS IN THE NON-SYMMETRIC UNIFIED FIELD THEORY. Mineo Ikeda (Hiroshima Univ.). Progr. Theoret. Phys. (Japan) 15, 1-11(1956) Jan.

Boundary conditions in the non-symmetric unified field theory were studied from the covariant point of view. The covariant expression of spatial infinity is obtained by generalizing the one ordinarily used in physics. A new boundary condition is proposed which is covariant for arbitrary coordinate transformations and reduces in a special case to the ordinary condition in general relativity. The newly-proposed condition is compared with the non-covariant one. For the static solutions of the field equations in the electric or magnetic case, the new condition is shown to be equivalent to those proposed previously. (auth)

2205

REMARKS ON HEISENBERG'S NON-LINEAR FIELD THEORY. Hideji Kita (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 15, 83-5(1956) Jan.

Inconsistencies in Heisenberg's non-linear field theory are presented and discussed. (D.E.B.)

2206

NUCLEOMESODYNAMICS IN STRONG COUPLING. II. THE GROUND AND ISOBAR STATES, NUCLEON CHARGE AND SPIN. V. N. Baier and S. I. Pekar (Institute of Physics, Ukrainian SSR). Soviet Phys. JETP 3, 340-50(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 317-29(1956) Feb. (In Russian)

A nucleon is considered that interacts strongly with a pseudoscalar meson field. The interaction is assumed to be of the symmetric pseudovector type. The eigenvalues of the energy, charge and spin of the nucleon are determined, and also the explicit form of the wave function of the system. The ground and isobar states of the system are obtained. (auth)

2207

MESON FIELD THEORY. II. CONSERVATION OF PHYSICAL QUANTITIES. A. A. Borgardt (Dnepropetrovsk State Univ.). Soviet Phys. JETP 3, 312-14(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 330-3(1956) Feb. (In Russian)

The densities of physical quantities and conservation laws for meson fields with anticommuting matrices were investigated. (F.S.)

2208

GENERALIZED FORM OF THE DIFFUSION EQUATION FOR A SINGLE PARTICLE. L. Janossy. Soviet Phys. JETP 3, 315-22(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 351-61(1956) Feb. (In Russian)

A general formulation is given of the diffusion equation for a single particle, from which follow a number of well known equations as special cases. By way of application, the scattering of particles in a homogeneous absorber is considered. (auth)

2209

RELATIVISTIC DEUTERON DISINTEGRATION IN THE ELECTRIC FIELD OF THE NUCLEUS. L. N. Rosentsveig and A. G. Sitenko (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 3, 456-8(1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 427-8(1956) Feb. (In Russian)

The disintegration of deuterons with energy of the order of 200 Mev in the electric field of the nucleus was investigated taking into account relativistic effects. (F.S)

2210

MOTION OF A CHARGED PARTICLE IN AN OPTICALLY ACTIVE ANISOTROPIC MEDIUM. I. A. G. Sitenko and A. A. Kolomenskiĭ (Academy of Sciences, Ikrainian SSR and Academy of Sciences, USSR). Soviet Phys. JETP 3, 410-16 (1956) Oct. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 511-17(1956) Mar. (In Russian)

The Fourier method is used to obtain expressions for the components of the electromagnetic field and for the total energy losses of a charged particle moving in an optically-active anisotropic medium. (auth)

2211

ANGULAR MOMENTUM DISTRIBUTION AND THE SPATIAL DISTRIBUTION OF NUCLEONS IN NUCLEI. S. I. Larin (Moscow State Univ.). Soviet Phys. JETP 3, 615-17(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 587-9 (1956) Mar. (In Russian)

A relationship was established, using the Thomas-Fermi model, for the angular momentum distribution and the spatial distribution of nucleons in nuclei. (F.S.)

2212

ON THE THEORY OF ASYMMETRIC FISSION OF HEAVY NUCLEI. S. G. Ryzhanov (Kishinev State Univ., U.S.S.R.). Soviet Phys. JETP 3, 632-4(1956) Nov. Zhur. Eksptl.' i Teoret. Fiz. 30, 599-601(1956) Mar. (In Russian)

The dependence of the yield of fission fragments on their

charges and mass numbers in the case of spontaneous fission, as well as in the case of fission by thermal and fast neutrons, was obtained by adopting Frenkel's hypothesis regarding spontaneous and induced fusion as a tunnel effect originating from the ground or excited state of the fissioning nucleus. The potential barrier for fission is assumed to be due to the specific nuclear potential "well" or the electric repulsion of the fragments. (F.S.)

2213

ON THE INTERACTION BETWEEN NUCLEON AND ANTINUCLEON. Iu. A. Tarasov (Moscow State Univ.). Soviet Phys. JETP 3, 636-8(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 603-5(1956) Mar. (In Russian)

The interaction between nucleons and antinucleons was investigated by the Tamm method. It was found that the interaction potential between two nucleons. (F.S.)

2214

NONLINEAR EQUATIONS IN QUANTUM FIELD THEORY. V. Ia. Fainberg (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 644-5(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 608-9(1956) Mar. (In Russian)

The equation for Green's function of the meson-nucleon system which is simply related to the matrix element of the S-matrix for the scattering of mesons by nucleons is used as a proof to show that Low's equations follow from general relations for the Green's function starting from general requirements of relativistic invariance, causality and boundary conditions. (F.S.)

2215

DENSITY OF LINEAR BOILING OF A SUPERHEATED LIQUID ALONG THE TRACK OF AN IONIZING PARTICLE. G. A. Askar'ian. Soviet Phys. JETP 3, 640-2(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 610-11(1956) Mar. (In Russian)

The elementary theory of induced boiling based on the electrodynamic model of stimulated disturbance of superheated liquids was developed. Qualitative results of the theory were the separation of the variables which characterize the ionizing particles and the variables which characterize the state of the medium and the linear dependence of the boiling density on the ionizing power of the particles. (F.S.)

2216

ENERGY SPECTRUM OF HIGH ENERGY IONIZING PARTICLES PASSED THROUGH A THICK LAYER OF MATTER. Iu. F. Orlov. Soviet Phys. JETP 3, 647-9(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 613-14(1956) Mar. (In Russian)

A more accurate distribution function than the Gaussian was found to be used in finding the energy spectrum of high energy ionizing particles passed through a thick layer of matter. (F.S.)

2217

APPLICATION OF SINGULAR INTEGRAL EQUATION THEORY TO PROBLEMS OF THE SCATTERING OF PARTICLES IN AN EXTERNAL FIELD. N. P. Klepikov (Institute of Nuclear Problems, U.S.S.R.). Soviet Phys. JETP 3, 550-3(1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 701-6(1956) Apr. (In Russian)

The possible application of singular integral equation theory to the calculation of the scattering phases of particles in an external field is given. The case of scattering by a δ-potential is considered as an example. (auth)

2218

ON THE SINGULARITY OF THE ELECTROMAGNETIC POTENTIAL IN THE HIGHER APPROXIMATIONS OF PERTURBATION THEORY. Iu. M. Lomsadze (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 554-8 (1956) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 707-12(1956) Apr. (In Russian)

It is shown that the singularity at the origin in the potential of the electromagnetic interaction of two electrons (or of an electron with a positron), taken in any, arbitrarily high, approximation of perturbation theory, involving the nth power of the charge, is not of higher order than $(1/r)\ln^{(n-2)/2} r$. (auth)

2219

ELECTROCONDUCTIVITY OF INSULATION MATERIALS BEFORE, DURING, AND AFTER IRRADIATION. I. M. Rozman and K. G. Tsimmer. Zhur. Tekh. Fiz. 26, 1681-8 (1956) Aug. (In Russian)

A description is given of a new and simple method for measuring the electroconductivity of insulating materials before, during, and after irradiation and for measuring the relations of conductive properties to the temperature. The application of this method in measuring the electroconductivity of compressed amber, polystyrene of various purities, polymethylmethacrylate, polyethyl, and polychlorotrifluorethylene is described. (R.V.J.)

TRACER APPLICATIONS

2220 OSR-TN-56-561

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies. CONTINENTAL WATER BALANCE, GROUND WATER INVENTORY AND STORAGE TIMES, SURFACE OCEAN MIXING RATES AND WORLD-WIDE WATER CIRCULATION PATTERNS FROM COSMIC RAY AND BOMB TRITIUM. Friedrich Begemann and W. F. Libby. Nov. 15, 1956. 38p. (AD-110381).

URANIUM AND URANIUM COMPOUNDS

2221 ANL-5053

Argonne National Lab., Lemont, Ill.

THE FABRICATION AND PHYSICAL PROPERTIES OF URANIA BODIES. Work completed: August 1954. W. A. Lambertson and J. H. Handwerk. Feb. 1956. 48p. Contract W-31-109-eng-38. $0.50(OTS).

The fabrication methods employed in forming urania bodies are reviewed. The density of urania appeared to increase with a decrease in the particle size of urania used, and with an increase in firing time and temperature. The melting point of urania was redetermined, and found to be 2880 ± 20°C. The thermal expansion of urania was found to be linear up to 950°C and the average thermal expansion from room temperature to 950°C was found to be 10×10^{-6} cm/cm/°C. The thermal conductivity is reported to be 0.016 cal/sec/cm/°C at 100°C, and the hardness was found to be approximately 6 to 7 on Moh's scale. The specific resistance was found to be 315 ohm-centimeters at room temperature, and the modulus of rupture was found to be approximately 26,200 psi. Specimens were corroded in water, hydrogen peroxide solutions, and NaK eutectic alloy. The urania was found to be resistant to corrosion in water up to 315°C, and to dilute hydrogen peroxide solutions. Specimens of high density urania heated slowly in NaK alloy to 600°C were found to be in good condition after 72 hours. This would indicate that urania is resistant to corrosion by NaK alloy. Specimens dropped in NaK alloy at 400°C were found to fracture, which would indicate that urania is susceptible to thermal shock. Specimens irradiated to low burnups showed cracking, presumably due to the thermal gradients existing in the specimens during irradiation. The phase systems UO_2-O, $UO_2-Al_2O_3$,

$UO_2-Nd_2O_3$, UO_2-ZrO_2, UO_2-ThO_2, UO_2-MgO, and U_3O_8-MgO are reviewed. (auth)

2222 ANL-5347
Argonne National Lab., Lemont, Ill.
MICROSCOPIC OBSERVATIONS OF HIGH PURITY URANIUM SUBJECTED TO THERMAL CYCLING. Final Report—Metallurgy Program 5.1.14. Work completed: January 1955. R. M. Mayfield and L. T. Lloyd. Sept. 15, 1956. 65p. Contract W-31-109-eng-38. $0.40(OTS).

Observations of the microstructural changes and deformation mechanisms which occur in coarse- and fine-grained high-purity U as a result of heat treatments between room temperature and 500°C indicate that thermal cycling growth embodies some of the features which have been observed in creep studies of Al. Coarse-grained specimens deformed by slip and twinning within the grains, as well as by grain boundary deformation. Intragranular slip ascribed to the {110} planes was observed in addition to prominent slip on the (010) planes. The amount of grain interaction is dependent upon the angle between the two [010] axes; as this angle increases the interaction increases. The fine-grained specimens deformed by grain interaction and grain boundary migration, together with some intragranular slip and grain boundary sliding. (auth)

2223 HW-42532
Hanford Atomic Products Operation, Richland, Wash.
METALLOGRAPHY OF IRRADIATED URANIUM. James R. Morgan. Mar. 30, 1956. Decl. May 1, 1956. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

2224 K-1306
Oak Ridge Gaseous Diffusion Plant, Tenn.
LOSS DUE TO A SPLIT CASCADE UNDER DIFFERENT MODES OF OPERATION. J. E. Murphy. Dec. 13, 1956. 49p. Contract W-7405-eng-26. $0.35(OTS).

A square cascade is considered initially at steady state with product withdrawal. A section is removed and two modes of operation during the fault are considered. In Mode 1, the cascade is split until the fault is removed and in Mode 2 the shortened plant is joined immediately. A comparison is made between the losses sustained with each proposed mode. The results indicate that the difference between the losses is very small and that it is probably best to maintain split operation for some time. The best time to join may be some time before the concentrations match on both sides of the break. Current practice joins the cascade when these concentrations match. (auth)

2225 LA-2059
Los Alamos Scientific Lab., N. Mex.
SAFETY CONSIDERATIONS FOR THE ROLLING OF URANIUM SHEET. James G. Stearns. July 1956. 10p. Contract W-7405-eng-36. $0.15(OTS).

Although basic safe operating procedures that apply to the rolling of most metals can be applied to uranium rolling, additional safeguards must be incorporated that not only take cognizance of radioactivity and chemical toxicity but also recognize the peculiar pyrophoricity of the metal. It is the latter trait that presents unique problems not elsewhere encountered. Safetywise, the rolling of either normal or depleted uranium is the same; however, in addition to any safeguards applied to normal or depleted uranium, another factor, nuclear safety, must be considered when enriched uranium is rolled. Essentially, nuclear safety is the control of weight, shape, and tamping factors of enriched uranium. In the preparation for and the allied equipment to be used with rolling processes, considerable planning must be carried out. (auth)

2226 TID-3064
Technical Information Service Extension, AEC.
ENRICHED URANIUM FUEL MATERIALS: A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. Gifford A. Young, comp. Aug. 1956. 37p. $0.30(OTS).

Unclassified reports on processing of enriched UF_6 into U metal, U-base alloys, UO_2, and UO_2SO_4 for use as reactor fuels are annotated. Recovery of enriched U scrap, methods of isotopic analysis, health physics, criticality problems, and materials management are emphasized. A few references to papers presented at the Geneva Conference, 1955, and other nonreport literature are included. 254 references. (auth)

2227
ON THE QUADRUPOLE MOMENT OF THE U^{233} NUCLEUS. A. G. Zimin and N. M. Yashin. Doklady Akad. Nauk S.S.S R. 109, 283-4(1956) July 11. (In Russian)

Spectroscopic studies were made of the neutral and ionized nucleus U^{233} hyperfine line structure and nearly 50 lines of six-component hyperfine structures were revealed, confirming the previously established U^{233} nuclear spin value of $I = 5/2$. The hyperfine structure of emission lines in the ground state of the $5f^36d7s$ configuration was studied and the table of the emission lines presented, with the accuracy of intervals up to $\pm 0.002\ mc^{-1}$. The analysis of the relative intensities of the components and the interval between the emission lines showed that the hyperfine structure of the lines have resulted from the fission yield in both upper and ground levels with a more intensive fission on the ground level. The quadruple optic moment was calculated by $\langle r^{-3} \rangle$ for configuration $5f^3$ offered by Sternheimer Phys. Rev. 84, 244(1951) and the result showed $Q_{ep} \approx 13 \times 10^{-24}\ cm^2$. (R.V.J.)

2228
THE BEHAVIOUR OF INTERFACES IN LIGHTLY WORKED URANIUM DURING RECRYSTALLIZATION. P. E. Madsen (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 85, 71-5(1956) Oct.

The boundaries of twins and kinks in uranium appear to possess an appreciable surface energy, and on the annealing they undergo alterations which would be expected from a tendency to reduce the surface area. Phenomena such as twins becoming free from grain boundaries, twins becoming joined over part of their length, and strain-induced boundary migration are readily explained on this basis. (auth)

2229
LOCALIZATION OF THE URANIUM IN THE LAMELLAE OF THE ALLOY, BY AUTORADIOGRAPHY IN THE MEDIUM OF NUCLEAR EMULSIONS. C. Beets (Centre des Etudes pour les Applications de l'Energie Nucleaire, Bruxelles, Belgium). J. Nuclear Energy 3, 45-8(1956) Aug. (In French)

An autoradiography with an Ilford D_1, 50-μ plate in close contact with the sample enables one to locate the radioactive component (uranium) in lamellae included in the alloy. The plate location is registered upon the sample surface by means of optical marks. Simultaneous microscopic examination of tracks and sample surface through the glass of the plate is possible with the Leitz 22×, and Koriska 30× objectives which have a large field depth. Painting the emulsion directly onto the plastic coating of the sample and developing without stripping it, increases the resolution. The emulsion does not strip from the plastic coating when the latter is treated in the same manner as glass before casting the nuclear emulsion. Simultaneous microscopic examination of tracks and sample surface is now possible with the 50× and 100× objectives. (auth)

2230

ENERGY DISTRIBUTION OF MASS-97 FISSION FRAGMENTS FROM THERMAL-NEUTRON FISSION OF URANIUM-235. Bernard L. Cohen, Anna Foner Cohen, and Charles D. Coley (Oak Ridge National Lab., Tenn.). Phys. Rev. 104, 1046-53(1956) Nov. 15.

The energy distribution of mass-97 fragments from thermal neutron induced fission of U^{235} was measured with a high-resolution magnetic spectrograph. The fragments originate in a thin plating of U^{235} near the center of the Oak Ridge National Laboratory graphite reactor and travel 16 feet to a wedge magnet which analyzes and focuses them at the focal plane 6 feet beyond. There they are caught in an aluminum foil which, after the irradiation, is cut into strips each of which is radiochemically analyzed for Zr^{97}. The $H\rho$ distribution is complicated by the large energy width which leads to overlapping of momentum distributions from successive charges. An analysis of the shapes of the $H\rho$ distributions obtained with different relative charge populations determines that the width of the energy distributions is (11.4 ± 0.8) % corrected for broadening due to prompt neutron emission. This result is in agreement with measurements of the distributions of the number of neutrons per fission but is in sharp disagreement with the predictions of Fong's theory of the fission process. The most probable energy is 174.7 ± 2 Mev for the mass-97 fission mode, and about 164.5 ± 3 Mev for the mass-91 mode. (auth)